This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

NYPL RESEARCH LIBRARIES
3 3433 06644541 6

PAW
Calleja

GENERAL PHYSIOLOGY

OR

PHYSIOLOGICAL THEORY OF COSMOS

BY THE SAME AUTHOR.

PRINCIPLES OF UNIVERSAL PHYSIOLOGY: A Reform in the Theory of Physics, Chemistry, Biology, and Cosmology. Crown 8vo, 3*s*. 6*d*.

THEORY OF PHYSICS: A Rectification of the Theories of Molar Mechanics, Heat, Chemistry, Sound, Light, and Electricity. Crown 8vo, 5*s*.

LONDON: KEGAN PAUL, TRENCH, TRÜBNER & CO., LTD.

GENERAL PHYSIOLOGY

OR

PHYSIOLOGICAL THEORY OF COSMOS

A RECTIFICATION

OF THE

ANALYTICAL CONCEPT OF MATTER AND OF THE SYNTHETICAL CONCEPT OF BODIES

RESOLVING THE PROBLEM OF

THE UNITY OF ALL OBJECTIVE KNOWLEDGE

BY

CAMILO CALLEJA, M.D.

LONDON
KEGAN PAUL, TRENCH, TRÜBNER & CO., LTD.
1890

THE NEW YORK
PUBLIC LIBRARY
479433
ASTOR, LENOX AND
TILDEN FOUNDATIONS.
R 1910 L

(*The rights of translation and of reproduction are reserved.*)

PREFACE.

IN this work our principal aim is to comprehend under the fundamental principle of mechanism—*conservation of energy*—all the laws and theories concerning nature. To reach to this positive point we unite and rectify many contradictory ideas at present scattered throughout the current treatises on Metaphysics, Philosophy, and Cosmology, and on Physics, Chemistry, and Biology.

This comprehensive theory we call "physiologic," applying this qualification in its original and etymological meaning—"discourse of nature,"—and with the same signification we have employed the name *Universal Physiology*, in order to denote the study of positive science in the *abstract* sense. We divide Universal Physiology into General and Special, subdividing each into Analytical and Synthetical. Therefore this *General Physiology* comprehends two parts; the first, Analytical, rectifies the concept of *matter*, and of all general terms referring to it, such as substance, force, mass, movement, etc.; and the second, Synthetical, rectifies the general ideas of the different aggregates of matter—*bodies*—in their three degrees of complexity: inorganic, organic, and planetary. The work on "Theory of Physics" (already published), and that on Biology (in preparation) are the complements of this "General Physiology," the three composing the whole "Universal Physiology;" our "Theory of Physics" corresponding to the Special Analytical part, and "Biology" to the Special Synthetical part of our "Universal Physiology."

We maintain that the before-mentioned principle of mechanism is not the generating cause of the System, that the sole true agent is the Creator, whose primordial effects are produced solely upon living matter, and that thus the potence of vitality becomes the proximate cause of all phenomena, which, consequently, are only changes of matter uniformly derived by simple propagation of movement. This affirmation, which is justified in this work, resolves the highest problem of mental speculation by discovering the unity of all objective knowledge, for as the universe is a system, a theory of its activity must be universal, not partial; and if a mutual connection does indeed exist among all material changes, our reason, logically theorizing, must arrive at unity.

The inquiry into the Physiological Theory of Cosmos must carefully follow the laws of thought, and the rules of a severe logic, in order to avoid mistakes to which the mind is so predisposed, that all writers on Physics have fallen into them by setting forth contradictory ideas, and by denying the reality of some existing things and forms of activity without any other reason than that they cannot be weighed or touched, when all we know as real existences are necessarily acquired, not by the irreflexive observation of the senses, but under the guide of reason—rational experience. For such a purpose this book opens with an "Introduction," giving the psychological and logical data necessary to develop and understand correctly the Physiological Theory. In addition, the work closes with a recapitulation of our principal conclusions, and a summary of definitions, in order to show at a glance the new ideas here given.

C. C.

LONDON, 1890.

CONTENTS.

PAGE

INTRODUCTION TO PHYSIOLOGICAL THEORY 1

Outlines of Psychology and Logical Data: Subject and Object—Division of Subject—Sensations—Thought—Physiological Knowledge — Physical Inquiries — Validity of Hypotheses—False Doctrines—Province of General Physiology.

PART I.

ANALYSIS OF COSMOS: ANALYTICAL CONCEPT OF MATTER.

CHAPTER

I. GENERAL CONCEPT OF MATTER: A. ULTIMATE ABSTRACTIONS OF MATTER 65

II. GENERAL CONCEPT OF MATTER: B. RELATIVE SIGNIFICATION OF ALL MATERIAL TERMS 89

III. PONDERABLE MATTER: INDIVISIBLE PARTICLES, OR *Atoms* 123

IV. IMPONDERABLE MATTER: VARIABLE PARCELS, OR *Progene* 145

PART II.

SYNTHESIS OF COSMOS: SYNTHETIC CONCEPT OF BODIES.

V. GENERAL CONCEPT OF BODIES: ATOMS AND PROGENE TOGETHER 184

VI. CONCEPT OF LIVING BODIES: SOLIDS AND FLUIDS TOGETHER 214

CHAPTER P
VII. CONCEPT OF CELESTIAL BODIES: INORGANIC AND ORGANIC BODIES TOGETHER ... ...
VIII. CONCEPT OF THE UNIVERSE (GOD, MIND, AND MATTER): CRITICISM ON COSMOGONY ... ...

PRINCIPAL CONCLUSIONS OF THE PHYSIOLOGICAL THEORY ... ...
SUMMARY OF DEFINITIONS ... ...

GENERAL PHYSIOLOGY;

OR,

PHYSIOLOGICAL THEORY OF COSMOS.

INTRODUCTION TO PHYSIOLOGICAL THEORY.

Outlines of *Psychology* and *logical data* necessary as a condensed guide to follow physiological studies—§ 1. Subject and Object—§ 2. Nominal divisions of the Mental Subject—§ 3. Sensations and their classification—§ 4. Thought and perception as its leading factor—§ 5. Origin and character of physiological knowledge—§ 6. Process of reasoning in physiological inquiries—§ 7. Validity of hypotheses in Physiological Theory—§ 8. Brief criticism of Realism, Eclecticism, Scepticism and Empiricism—§ 9. Brief criticism of Monism, Pantheism, Idealism, and Materialism—§ 10. Province of General Physiology.

§ 1. SUBJECT AND OBJECT.

WE must commence the study of mental activity by fixing the meaning of the terms *subject* and *object*, because they are frequently used by authors not only with impropriety, but also in an equivocal manner.

The word subject is commonly employed in three different significations: in the grammatical sense it means that of which something is affirmed; in the ontological sense it represents the supposed universal

~7

substance—substratum—which is illusively considered as the common basis of all things; and in the psychological sense it is assigned and admitted (by Kant and Fichte) as the knowing principle.

But some psychologists have employed the words *subject* and *object* in a signification contrary to that given by Kant and Fichte, calling object the capacity of knowing instead of representing what is extrinsically known. The confusion has become still greater because some authors, after having defined *subject* as the sentient individual with capacity for sensation and thought, containing in himself the principle of activity, add that "the subject can be an object also." Of course, by such a contradiction, they do not mean to convey the idea that the mind can be observed by the senses as a true cosmical object; they only wish to express that it can be studied by the thoughts which it produces. But the mind is not susceptible of any division, as in the activity of thought we know only the ideas which it produces, and, consequently, if some authors consider thought as an object, it can be only as a mere mental abstraction from an illusory substratum of substantial thought. Sensation and thought are never perceived separately outside of one's own personality, in the same manner, for example, as colour or movement cannot really exist apart from objects. Accordingly, there is an inextricable confusion in the philosophical use of the word *subject* and of its opposite, *object;* nevertheless we will adopt them always, employing the word *subject*, however, as a synonym of the *mind* which must be recognized and admitted as an activity different from that which is manifested through the senses, *i.e.* matter. Hence we admit the distinction between spiritual and material created beings in harmony with two different kinds of knowledge. Our knowledge of the *spirit*, *subject* or *mind*, is purely intellectual; the data of intrinsic intuition cannot be acquired by the senses, nor be submitted to any direct experimental proof; while our knowledge of *matter*, *object* or *nature*, is based in sensual acquisitions and proofs. Hence the changes manifested in Cosmos, which, as we shall see, are determined by acts of vitality, are only known by objective states of consciousness, which are the effects of manifested changes called also phenomena. From phenomena we form the concept of matter—object or *non ego*, in opposition to the mental unity—subject or *ego*. The conception of spirit is acquired by the perception of qualities which constitute our conscious activity, and which are perceived only in the consciousness itself, for each subject perceives only his own sensations and not those of others, that is to say, the states of self-perception can never be felt by another than one's self, and for this reason the intrinsic perceptions are not "phenomena," but purely "noumena" from subjective perceptions (emotions and thoughts).

Accordingly, the nature of mental reaction depends on both—on the mental or subjective, and on the material or objective activity. We do not know what the first is; we shall see that the second is movement. Mental activity cannot be explained by movement, on the contrary, the differences among simple states of consciousness are qualitative, while movement can differ only in quantity. The organic activity of the brain is, of course, material; it is the propagation of movement by the nervous element that constitutes the encephalic mass, and nothing else.

These two kinds of knowledge referred to—*spiritual* and *material*—are under the immediate control of human perception, and in contradistinction to the Supreme Being or Primordial Cause, which our limited capacity of perception cannot comprehend, because, not being present in our consciousness we cannot directly know it. Thus we have made reference to three kinds of beings or things entirely different, God, mind (subject), and matter (object), which together may be called the universal trinity.

In accordance with this distinction between subject and object is our classification of the theoretical or speculative sciences we call *sophological*, which we group under two headings—*Physiology* and *Metaphysics ;* Physiology comprehending the study of object or material nature in its inorganic, as well as in its organized form, and Metaphysics comprehending the study of subject or mental activity, not only in created minds—Psychology—but also our conception of superhuman intellect or the Divine—Theology. In this introduction we principally though briefly explain the notion of the mental subject, in order to avoid falling into the error of confounding it with object, as do those who suppose that the activity of the mind is discovered by investigating the functions of nervous transmission, when, really, this inquiry, even in the most central organ of the system—the brain—reaches no farther than the knowledge of one of the forms of matter in movement. Such a mistake has led many physiologists into materialism. On the other hand, we need also the knowledge of a true, metaphysical base, because, without the notion of the fundamental ideas of the spiritual, we cannot infer the concept of matter, which is the foundation of our Physiological Theory.

§ 2. NOMINAL DIVISIONS OF THE MENTAL SUBJECT.

The acts of feeling and thought are symbolized in the entity which we call mind or psychical activity, and we say that the mind, in substitution of the personal subject, feels and thinks; the product of feeling we call sensation, and that of thinking thought.

Sensation and thought are not two different activities, but two successive degrees of single mental activity, because sensation is necessarily included in perception, which is the primordial and most essential factor of thought. Objective perception involves not only presentation of ideas, but also their representation—that is, the manifestation of ideas previously formed by objective sensations. Furthermore, the reproducing elements of knowledge (representation) are more important than the elements acquired in actuality (presentation). For this reason the processes of presentation and representation are necessary at the same time, in order to acquire the scientific knowledge of Cosmos (Physiology).

There are forms of representation, however, which do not involve any perception of actual presentation: such are the acts of memory and those of imagination; but even then the object may also be suggested by the senses through the act of association. Therefore mature perception involves in some manner representative activity, though in many perceptions presentation plays an important part, while in some others, being purely representative, it constitutes a special phase of mental activity in which the elements can even be combined in new forms.

The mind initiates the mental process with acts of sensibility, in which capacity it is an analyzer, for it makes a mental separation of the ideas on which abstraction depends. For the capacity of thinking the mind turns back to make the union of ideas or mental synthesis in order to form general concepts, or to particularize in concrete, that is, to attach to the objects all their concepts. Moreover, extrinsic sensation is one of the forms of thought, the predominating result of which is to affirm in our consciousness some special act of sensibility. External sensation is essentially a conscious process of the application of reflection to the impressions of the senses, in such a manner that our consciousness recognizes the existence of objective things; all the forms of mental activity contribute to this process, although the most remarkable is sensation. Certainly, in order to perceive the sensations, it is necessary to form in our mind an ideal construction of the world, and for this it is indispensable that the things which constitute it have sufficient activity to impress the mind in such a manner as to provoke a reaction in harmony with the conditions of the mind and the intensity of the excitation.

Spontaneous or irreflexive consciousness distinguishes *will* from *thought*, considering them entirely different, from which arises the classical division of the psychical into *sensation*, *thought*, and *will;* but the *will* is only a factor of *thought* which incites to discourse, in order either to know or to act with free will by means of contractions or muscular movements.

The representative power of the mind is called *memory* when past occurrences (supplied by experience) are reproduced as they first appeared in sensation. In memory, then, representation is identical with presentation. There are two classes of memory, one is spontaneous, suggested unconsciously by natural conditions, which may be qualified as irreflexive memory ; the other, on the contrary, is reflexive, consciously suggested by some scientific reason, either categorical or hypothetical, and may be qualified as rational or philosophical memory. Irreflexive memory is a factor or quality of sensation, including in this the power of association of ideas. Rational or reflexive memory is a factor or quality of thought, and this is most necessary for scientists.

Imagination, like memory, is often considered as a special faculty ; this mistake is the effect of the deceitful appearance of abstract language. Imagination is only a mode of thought in opposition to reasoning. Reflection follows the process of reasoning when the premises and conclusions affirm objective existences exactly as they are known by sensation. On the contrary, it follows the imaginary process when it represents or thinks of something which does not exactly correspond with the true observations of nature ; if abstract elements of experience are then reproduced, it is without the original order. The fruits of the imagination are called artistic when they are beautiful, that is, when they keep harmonic proportions.

Imaginary representations in general, and artistic representations in particular, may be either realistic or fantastic. Realistic representations are those which reproduce, or better, endeavour to reproduce as well as possible, natural objects in their culminating concepts, whether these contain one or more abstractions, as, for example, when one tries to represent the singing of a bird in music, or a human body in sculpture. Fantastic representations give us the conception of beings never presented to our senses, and, consequently, without identity with experienced objects, as, for example, when one tries to represent celestial sounds in music, or an angel in painting. Here we must use only realistic representations.

We see that, as the effect of an erroneous analysis of mental processes, authors admit many independent powers in the *mind* besides the intuitive, that of sensation, and the discursive, that of thought; but we must bear in mind that the words mental nature, perception, reasoning, imagination, intelligence, understanding, reflexive or rational memory and representative power are all comprehended in the true signification of the word *thought*, as they only denote partial states, acts, or factors of one and the same power. Even sensation and thought are not two independent powers. On the contrary, only by a mental division can they be conceived separately, though, in reality, they are mutually dependent on one another.

§ 3. SENSATIONS.

It is impossible to explain what a sensation is; we can only give verbal or tautological definitions of it in which the grammatical subject and predicate are synonymous expressions. Thus we say that sensation is a particular state of the sensibility of the mind which is referred to some external thing, that is to say, to matter—objects of the physical world or nature.

Proper or external sensation differs from emotion, because the latter is an intrinsic state of sensibility which is referred to the mind itself, though it may have some external impression or sensation as a remote cause. Again, we must distinguish conscious excitations or sensations from those which are unconscious, so limiting the meaning of the word sensation to the excitations or impressions which are produced in the peripheric part of the nervous system, and are transmitted to and perceived by our consciousness, and we must exclude the impressions which are not perceived from the list of sensations. The nerves which conduct excitations from the periphery of the system to the centre, that is to say, the transmittors of the centripetal currents, are the conductors of sensibility or estesodic nerves, calling senses the pheripheric organs which are at the end of such conductors in order to receive the special impressions.

There are four successive acts or operations in all sensations ; first, the impressions produced on the senses by the exciting cause ; second, transmission through the estesodic conductors to the nervous centres ; third, reception or presentation of the sensation in the brain ; and fourth, perception, appreciation, and discernment of the qualities which give our consciousness a more or less perfect discriminating idea of a sensation, which is referred back to the starting-point. We must remark that all excitation provoked in any part of a nervous conductor is not localized at the point where it originates, but towards the peripheric extreme of the excited nerves. Furthermore, the sensations have not the same limits as the peripheric excitations ; if we excite some determined part, it may happen that the impression will be perceived not only in that part but in the parts around it, or in parts more distant ; this, which is called association of sensations, is the consequence of propagation among the centres, and generally happens when the excitation is intense.

Sensations constitute the first mental order of reaction against extrinsic action, and are besides the inciting cause of the second order of mental reaction, that is, of the activity of thought. This consists in associating and unconsciously suggesting ideas of sensations, and afterwards reflecting, consciously of course, on the sensation already associated, and on the suggestions in order to form rational ideas, or to interpret them in accordance with certain ideas before acquired. Thus, then, we form two orders of ideas, for one of which our consciousness is in apparent passivity, while for the other we act with clear consciousness of mental activity, that is, with attention. To the first corresponds the activity of sensation, which includes the unconscious association of ideas; to the second corresponds the intelligent activity, which includes the reference of sensations to external objects.

The excitations produced in the different conductors of sensibility are not the same in their perception, and from this arises the different forms of sensations—objective qualities, so to speak. There are impressions which are only perceived when the excitation has its origin in determined organs or conductors occupying particular parts of the body, and which give us some notion about the nature of the exciting agent; these are called special sensations: sight, hearing, smell, taste, and touch. There is a second class of sensations, whose causing excitation does not need to act over determined organs in order to be perceived, and which do not give us any idea of the exciting agent; these are called common or general sensations: hunger, thirst, necessity of breathing, pain, etc.

The numerous forms of extrinsic impressions may be classified in two groups; one comprehending the sensations ordinarily produced, or which, at least, can be produced in an indirect or mediate manner, the object then referred to being more or less distant. For the propagation of activity to a distance, some means of transmission are necessary which must be in connection on one side with the object and on the other with the senses. This is a fundamental distinction, because while in the first case the object and the senses are in direct interaction, in the second the interaction is not directly between the object and the senses, because there is a double interaction—on one side between the object and the medium of propagation, and on the other between this medium and the senses. Each of these groups comprehends three kinds of sensations, making a total of six: first group, immediate sensations, touch (of pression), taste, and smell; second group, mediate sensations, thermic touch (heat and cold), hearing, and sight. The sensation of weight, that which gives us a knowledge of the application of muscular energy, is included in the tactile sensations.

The sensations which give us the idea of changes of temperature (heat and cold), though seemingly propagated principally by the tactile nerves, can also be referred to a distant object from which heat irradiates (as we shall afterwards explain), in the same manner as sound and light are propagated by means of an all-pervading, imponderable matter which physicists call "ether." It is true that in ordinary cases of practical life the thermic sensation is more frequently experienced directly than indirectly, at least with reference to terrestrial bodies; but the most original fact of thermic observation is distant propagation, such as heat from the sun, and frequently, also, that which emanates from combustion in a furnace.

The direct sensations, or sensations of immediate contact, result from the action of corporeal or ponderable bodies over the senses, it being also worthy of notice that for the special sensations of smell and taste bodies must necessarily be fluid ; solid bodies being, on the contrary, the best to determine tactile sensations of pressure. Indirect or mediate sensations result from the impression of a metafluid—the imponderable substance before mentioned, which we call *progene.*

We have in all six kinds of external sensations—touch (of pression), taste, smell, thermic touch (heat), hearing, and sight. We see, then, that the sensations are expressed by abstract words which represent the different states of consciousness—differences of quality—produced by extrinsic excitation. But we must notice that the acts of nervous transmission consist purely and simply in propagation of movement, and consequently that objective knowledge is acquired only by the *quantitative* differences from sensual propagation.

The total result of the process of extrinsic perception is the concept of objects in their relations with the different qualities or states of the receiving subject or mind. This makes it appear to us that the objects are contained in the mind ; but such contents are only objective symbols, and thus we acquire the knowledge of objective perception, not by inference, but by the association of those symbols. It is not the eye which truly sees the object, nor is it the ear which hears and understands ; it is the mind itself. Indeed, light, sound, or any of those changes of the world which produce the activities present in the mind, is not perceived by the senses, though by a figure of speech we say to see with the eyes, to hear with the ears ; what happens is, that we see, hear, etc., by means of the senses, but we perceive only with the mind. The initial activity of perception depends on the interaction excited between the mind and the senses by the external object; all that happens afterwards is a consequence inherent to subjective activity: association, unconscious suggestion, and reflection. We could not possess any idea of identity and consistency among objects if the mind constantly reacting did not correct the appearances of the sensations, but was strictly limited to the impressions produced by the senses. The mind is the sole thing which has the power of elaborating sensations and thoughts, in the same manner as the ovule is the sole object from which an organism can be formed.

§ 4. THOUGHT.

Thought, like sensation, is an ultimate term, which cannot be genesically explained, but only defined in a verbal or tautological sense; any such definition is composed of terms synonymous with that which is intended to be defined. When we think, we affirm or deny, we agree or disagree; the resultant of such a mental action we call judgment, and the capacity which contains all judgment is symbolized in the word criticism. If the result of the comparison of two concepts asserting either an agreement or disagreement in the relations which they express is a judgment, and a comparison of judgments is a reasoning by means of which we arrive at inferences (inductions and deductions) and calculations in which the expressed relations are known either by perceptible sensations (categoric knowledge), or by ideas acquired from pure thought (hypothetic knowledge), categoric knowledge relies upon the direct proof of experience in order to be considered as evident truth; while the hypothetic is not within the direct reach of the senses, but is warranted by the laws of thought and the rules of art which direct reason (Logic and Mathematics). When we reason we can compare in two ways; therefore there are two kinds of operations in reasoning: one purely logical—comparison of quality; the other mathematical—comparison of quantity. By the power of reasoning man can foresee what he has not seen, foretell what he has not heard, predict what is going to happen. But to accomplish this supreme operation of the mind we need theories whose starting-point is in the principles which are the subject of study in this work. Hence, there are various modes of thinking: first, formation of ideas of immediate perception—primitive ideas; second, formation of ideas by the comparison of immediate or primitive ideas (comparative ideas or common sense of the psychologists); third, remembrance of preformed ideas (remembered ideas or memory); fourth, acquiescence of ideas to the image and likeness of those already preformed, though not with reference to things that have not really been observed or experienced (imaginary ideas); and fifth, ideas arising from the comparison of judgments, that is, from reasoning (rational ideas inferred and calculated) But there are only three acts in the rational process of thought. The first act of reflection is comparison, which may be either qualitative or quantitative; the comparison of attribution is qualitative—substance and activity; and the comparison of relation is quantitative—space and time. The second act of reflection is to make assertions or affirmations about that which we have compared; this is judgment; the assertion or affirmation about that which is compared can express either similarity or difference, and this is the agreement or disagreement of judgment. The third act of reflection is reasoning, by which we acquire from inference and calculation some judgment different from those already known; the inference so acquired may be either inductive or deductive.

Thought generally needs attentive, though not always voluntary elaboration by which we form a notion of the object of sensation more or less complete; thus we see thought commences in the last act of sensation—primitive ideas, hence sensation is the initial element of reflection. Primitive ideas may be grouped, general notions resulting from those that are similar; in this manner ideas of more comprehensive signification are formed, and these are the general ideas called abstract.

The expression of ideas previously collected reveals to us that the mind has the property of preserving for some time the changes produced by sensation and thought; this is the retentive power of memory. Besides, some other special qualities of psychical activity are worthy of notice, *e.g.* the co-existence and succession of ideas, their association, the unconsciousness of some facts, and the lack of influence of the will over association of ideas and over some bodily impulses. Our consciousness can estimate whether the excitations which reach it have acted simultaneously or successively; nevertheless this knowledge has limits, as successive sensations when very near seem to us simultaneous; and yet, in order that we should become conscious of excitations, it is necessary that they should last a certain time, and then we not only acquire the consciousness of them but also of their differences and similarities (comparison).

The modifications produced in our mind can in their turn produce other modifications, especially when they have been reproduced more than once in immediate succession or almost simultaneously; from this arises the association of ideas with such pertinacity that they are produced without our will. Thus we see that the ideas are linked together, some having the tendency to associate with others, and all these facts approximate in the last analysis to vivid memory by virtue of which the connections once produced have the tendency to reproduce themselves newly.

Perception is the leading factor of thought; it is a combination of the different degrees of mental activity in order to acquire the knowledge of what impresses our consciousness. To effect this there must be interaction between the mental subject and the objects of sensation. In an interaction nothing is given by any one thing to another, the conditions of the manifested action being only propagated. Thus, for example, the results of the action of light are very different according as the object on which it acts is a green leaf, a photographic plate, or the retina. The form of the reaction depends on the two things which must act over each other in order to manifest any change, and when one of the two is the mind the reaction will be on this in order to produce sensation. For this reason, perception does not depend either directly or indirectly on the objects, but on the reaction of which the mind is capable as the effect of the special excitation or impression of the objects upon the nervous system. Hence a grotesque description is made in the order of the formation of ideas when it is said that objects stamp, paint, or impress themselves on the mind. The nervous propagation which produces sensations is not a picture nor an idea; nervous action cannot be anything more than propagated movement; it does not carry along alphabetic characters when we are reading any more than a book contains thoughts which could be transported by the nerves; for thoughts are developed or elaborated by the mental subject itself. Objective ideas, indeed, are products of the mind itself, which associates them under some laws forming the concept of abstraction, distinguishing and classifying these in order finally to refer them to the objects which incite sensation as their attributes or qualities, and to calculate the relations between them.

We classify the perceptions into perceptions of reasoning and of imagination, subdividing these into realistic and fantastic. Perceptions of reasoning can be either purely representative (memory), or presentative, this of course containing also representations. Hence, the perceptions qualified as presentative are mixed, for they need at the same time the help of the memory as well as the present sensations. We must bear in mind that the representations of reasoning are in exact accordance with the memory of forms previously observed, and that thus as actual sensations can enter into the perception of reasoning, so all the elements or abstract ideas are representative in the perceptions of imagination.

The following circumstance in regard to representative perceptions is worthy of mention in reference to Physiology: a case experienced will be more exactly reproduced the more links of connection there are among the data of sensation, as it will then be more intelligible. In fact, if the connection among the data is known, it is enough to remember the premises in order to call to mind the conclusions, if we have rational or philosophical memory; on the contrary, if the elements or mental connection are lacking, the case is easily forgotten, except by one of those irreflexive or spontaneous memories which, by a sort of unrolling of words, can reproduce them without any other connection than the immediate succession in which the words were acquired.

The knowledge which is the fruit of thought takes thought with its laws for a means, but the primordial or fundamental ideas are always derived from intrinsic and extrinsic sensations, that is to say, from the primordial facts which our mind discovers by immediate or direct perception, they being isolated without any connection in the existent system, and so lacking scientific character. Therefore, intuitions do not belong to Physiology, but to Ideology, a department of Psychology. In truth, the perception of objects is not complete as scientific knowledge until they are assimilated and classified; mental assimilation demands the ideal decomposition of objects into sensations, and classification requires the recomposition of the ideas by thought. Without these two circumstances our mind could not define or specify any object; it would only contain a vague and general idea of them. Nothing is quite definite so long as we are not able to refer it to one of the known classes, or at least while we cannot establish the relations fixing the similarities and differences with any of the classes already known. We comprehend the importance and necessity of classification only by noticing that all the terms of language are general, and therefore they pre-suppose the element of classification.

Nouns express only abstract ideas of attribution or of relation; and they always imply classification in their meaning, as to name a thing or apply any term as a predicate is an act of abstraction which pre-supposes classification.

§ 5. ORIGIN AND CHARACTER OF PHYSIOLOGICAL KNOWLEDGE.

Thoughts cannot be known by direct propagation from mind to mind, though they may be communicated by means of language; the mental subject, receiving the symbols which transmit the ideas, assimilates them with the ideal signs which represent them in the mind, and which in the ordinary form of transmitting ideas are words. Thus language is the progressive necessity of the mind as food is the conservative necessity of the body, and that sublime necessity of thought yielding supersensual fruit in the field of the ideas is the essential means of elevating us to the rank of rational beings.

In language there are two kinds of expression: intuitions (perceptions which are only felt), and propositions (perceptions which are thought, either inferred or calculated). Language is called propositional when it enunciates some new order of ideas by which we can acquire some knowledge not already experienced. A proposition, in order to be understood, presupposes that the abstract ideas which compose it are already known; and such ideas may be either intrinsic, that is, of self-consciousness (intuitions), or extrinsic ideas which have been previously discovered by means of the senses (sensual representations).

According to the theory of knowledge, the correlative succession in the acquisition of ideas is as follows: in the first place we get the predicates of attribution (ideas of substance and activity), whose aim is to reach qualitative inductions by comparisons among the qualities of the sensations; we afterwards reflect on the similarity and difference of attributive ideas in order to form the predicates of quantitative relation (ideas of space and time) whose aim is to know with the help of the axioms of Mathematics the comparison of the quantity of the sensations which are perceptible, not directly in matter, but in its mental representations. The ultimate inductions and true axioms once known, we may derive from them the other ideas combined with new sensations, following the rules of deductive logic and mathematical calculation; thus we get the deductions.

The universal act of knowledge is expressed by judgment which consists in the comparison of many concepts with the assertion of their equality or difference. But certain ideas of sensation in reference to the concepts which are compared must necessarily precede the judgment; and besides, it is necessary for the expression of knowledge that the mind should abstract from the judgment of particular cases some unity of thought, some analogy among them which is called the *universal* meaning; such universal ideas or common abstractions are a necessity for language, and for this reason the rational mind has an imperious tendency to ideal abstractions or generalizations, as the ovule has the tendency to nourish and reproduce. So we see that when many experiences have an element of common sensation, the mind has the condition required for abstraction, in order thereby to form a unity of thought with all similar sensations, and to appropriate this as a basis for the classification of ideas. Such a universal element cannot be known by any particular or direct experience; the formation of universal concepts is a constructive action—an assimilation of ideas by which these are converted into a product identical not with the sensations but with the mind itself, as the cellule transforms that which it assimilates into an organization similar to itself; and such mental products, called universal ideas, are not simply a sum but a multiplication in which there is a true generation of knowledge.

Thought, we have seen, is of two orders—spontaneous or automatic, and reflexive or voluntary; the first supplies the ideas necessarily acquired by unconscious activity which is inherent in the mind itself; the second makes thought by reflection a self-director with self-consciousness. Spontaneous thought, which is immediate or irreflexive, acquires the knowledge of things according as they are perceived by the senses, and ordinary language expresses such a form of thought. But cosmos thus explained will be known only vaguely and with inexactitude as it appears to our senses. For this reason reflexive thought, which is mediate or philosophical, must, in the domain of science, completely abandon the classification of immediate sensation, and for this purpose ordinary terminology must be changed, or at least fixed, in order to give clear, adequate, and exact symbols to scientific ideas.

No theory can be the fruit of intuition—it is the fruit of thought; and a physiological theory must not be invented by imagination, but planned by quantitative reasonings or calculations which are the fruit of reason. If the mind had only its capacity of sensation, even having the capacity of forming direct judgments, it could not follow discourse; and with sensation alone we could not even refer the impressions to the objects which produce them. Objective perceptions are the data for the knowledge of cosmos, but our ideas of the world are conceptual abstractions, which the mind forms by reasoning.

The interaction of matter and mind may produce either subjective differences—qualitative ideas, or objective differences—quantitative ideas of space and time. The subject (mind) is known by qualities or attributive differences alone, and not by quantitative differences; the object, on the contrary, is known by quantitative differences or different relations, and not by qualitative differences either of substance or activity; that is, objective perceptions which are the first data for the knowledge of Cosmos or ideas of the world are formed by mental abstractions from sensations whose differences are only in quantity. Thus matter and mind (object and subject) can only be known by their reciprocal action (interaction); there is no state of consciousness regarding the knowledge of matter in particular, which is not determined by such mutual action. Now, if we think that objective knowledge (that of material nature) is valid, we must also admit that there is a fixed relation among its antecedents; and the sensations which result from the interaction of things and mental activity, must produce the same perception when the extrinsic excitation is the same. Physiological knowledge is based or founded in the perception of mutual actions among objects, that is, in their relations, because all the properties of an object are finally reduced to the condition of producing effects by interaction among things, and such effects, in order to determine sensations, must produce some change in the organs of sense, manifesting themselves to the mind after their propagation through the nervous conductors and centres. A thing alone cannot be known or conceived, because its existence would not be the object of sensation or of representation in thought. A thing really objective, then, is a term in an infinite series of things which are in mutual dependence, as without this there can be no possible form of reality known, either by experience or by pure thought. Accordingly, those cosmical determinations, which are generally called qualitative, because they cannot be numerically determined, are as quantitative as those which can be numerically determined. Quality directly results from the mutual action between the objects and the mind by an immediate connection without reflection —irreflexive perception, or *attribution;* and quantity is a relation, either numerical or of extension, among terms by mediate or reflexive connection—reflexive perception or *relation* properly so-called. There is nothing then truly attributive in objects, as the attribution or difference of quality is purely subjective or mental; while objective differences, on the contrary, depend on quantity, and are material or mechanical relations. Let us now fix well in the mind the idea that determinations of quantity only, such as physiological inquiries, can be derived one from another in accordance with general relations which are called laws. Scientific judgment manifests some fact or syntheses of facts of the universal system, and we learn such facts and syntheses by the concourse of three kinds of ideas, namely, intrinsic intuition, experience, and reasoning; but there is no doubt that experience is the principal origin of all the explanation that can be given of nature, and that reasoning about cosmos has the data of experience for its foundation, or, in other words, that physiological knowledge is acquired by reasoned experience. Concrete sciences are not founded on any data of intrinsic intuition, but we cannot deny the contribution of this in Abstract or Universal Physiology; nevertheless, it is general among most physicists to deny intuition in all questions of nature. Rigorous logical proofs of the ultimate explanations of science, are impossible without accepting some principles which are evident by their simple enunciation with the sole guarantee of intuitive assertion or self-evidence, because otherwise there is not sufficient reason to consider a truth strictly universal, and no evident proof could ever reach its limit. Even in the fundamental truths of Mathematics there are no other proofs than their self-affirmation, and the so-called laws of nature are nothing but quantitative relations. Facts directly acquired by experience, and propositions which have been proved and recognized as evident by sensual data, are the most numerous elements of scientific knowledge. In addition to this, there are some principles which are only beliefs; thus, for instance, we believe and assert as truths all the propositions whose denial involves contradiction in self-consciousness or impossibility of thought; the assertion of the *uniformity of nature* is also a simple belief; and only by faith alone have we confidence in the testimony of others about their scientific investigations and speculations. Many beliefs are indeed asserted without reasoning, as they do not represent either inferences or calculations, but only mental inherences; and, besides, there are many tendencies very common to all people, which cannot be submitted to logical proof, and it may be said that their certainty surpasses the ideas capable of a logical demonstration.

We repeat that all objective or physiological knowledge is acquired by mutual action between the object and the mental subject, but this interaction must be subordinated to the postulate of *uniformity* in the supreme purpose or end, otherwise equal antecedents could produce different consequents, and from this *chaos* only, instead of *system*, could result in the universe.

Phenomena or manifested changes of objects are the data for the senses, and ideologists usually say that such data may be contradictory one with another, and therefore deceitful. But all physical or natural reality is material, and its knowledge is derived from what is manifested by the senses. If the sole proof of physical reality is sensual experience, the assertion that the testimony of the senses is deceitful is not true; in fact, the sensations may deceive us, but they are also the testimony to prove the evidence of our knowledge. The data of the senses may be contradictory if we take for a moment only one sensual datum isolated from the data of the others; for any sensual datum whatever is complementary, and must be rectified by other data taken from the same sense, or by the other senses. The true distinction between what is apparent and what is evident knowledge of nature is that the apparent is a partial inquiry or a contribution to the total evidence. An illusion of the senses results from testing them in an inconvenient and incomplete manner, so leaving the assertion without evident confirmation.

It is clear that all sensual proof requires the reflection of thought, and therefore that all knowledge, including the experimental, is not only the fruit of observation but also of reasoning. Knowledge is always, in fact, the fruit of mental elaboration; it is a reflexive and not an immediate act; it is, without any doubt, an intellectual product, and not alone a sensual one, but to prove the truth in the interpretation of natural phenomena, experience must supply numerous and correct facts. From these facts of observation we acquire the separate primordial ideas which are the basis for the knowledge of nature; for without such a foundation the human mind could only build a fantastic world, and whimsically fix laws to govern it.

The power of the mind in the study of nature must be limited to discover, not to invent. Hence, pure reason alone is not sufficient to form a rational theory, nor are the particular experiences (which are under the jurisdiction of the senses) sufficient to elaborate a theory, as this is a mental synthesis. Both orders of mental activity—sensation and thought—are complementary in the acquisition of physiological science; both, then, must work together to arrive at the rational conceptions of true generalizations, and to prevent us from reaching imaginary results. Pure thought without a deep observation of phenomena can give rise to imaginary ideas alone, which, ordinarily, are only chimerical suppositions about nature, like the innumerable hypotheses of the Greek philosophers. But to believe in our external sensations, without submitting them to the examination or proof of reason frequently produces false conclusions also, as, for instance, we might think that the sun revolves around the earth if we trusted the evidence of our eyes alone. Errors of perception may occur, either by perturbation in the means of transmitting sensation (abnormal nervous action), or by differences in the association of ideas, or else by the arbitrariness of which mental influence is capable, especially in its most essential product—language, which is so frequently fallacious. All these may change the conditions of propagation, either materially or verbally, and therefore may change the qualities of perceptions; these are mistakes which can only be avoided by careful experience and logical reasoning. Hence, strictly speaking, experience is the source and proof of all knowledge of nature, but the generalization of ideas in science is far beyond the limits of our sensual observation, which must be subordinated to the supreme capacity of the mind—*reason*. Thus, in a figurative sense, we may say that experience, supplying the particular facts as antecedents, is the mother of science; and reason, elaborating the generalization necessary for the speculations of theory, is its mentor.

§ 6. PROCESS OF REASONING IN PHYSIOLOGICAL INQUIRIES.

We have seen that true scientific propositions always enunciate mediate or reflexive knowledge acquired by means of some ideas already known; and that for this reason language, by the use of propositions, serves to transmit scientific knowledge. Let us see now, how the process of reasoning follows physiological inquiries.

The *uniformity of nature* is the only guarantee for the logical proof of all inferences, applying this denomination only to qualitative reflections which may be either inductive or deductive, but not comprehending in them the calculations, that is to say, reflections about quantity. Induction is the discursive process from which generalizations are inferred, trusting in the law of uniformity of nature; or, in other words, induction is a prognosticated generalization warranted by the belief that in all cases of the same kind the future, and that which has not been observed, will be identical with what has already been experienced; thus, for example, the day always succeeds the night, and the night the day, and from this we infer that the same will always happen in future; again, we know that an electric current passing through a mixture of oxygen and hydrogen produces water, and from this we infer that the same will always occur; still another example, some animals and people have died a short time after taking prussic acid, and consequently we infer that prussic acid is a poison for all such beings. With such a guarantee, physiological science, referring to the whole cosmic mechanism, has arrived by reasoning at this ultimate induction: in the changes of nature nothing is created nor annihilated—conservation of matter and energy (substance in activity); and we must remark that the principle here qualified induction, although it has not been proved by calculation, does not suppose that all manifested or phenomenal energy has been created at one time, or has eternally existed, but only that all physical energy, including latent, neither increases nor diminishes. The law of continuity in Cosmos is only true if we admit that the reparation of manifested force is constantly engendered by the potential energy of vitality, that is, by the genesic activity of living matter, which draws out energy from the latent state to the phenomenal; material change being thus constantly originated.

Mental reflection not only generalizes but also particularizes, inferring special cases that are comprehended in inductions already known, and such form of inference is called deduction; thus, for example, we make a deduction when we say this substance is prussic acid, prussic acid is poison, consequently this substance is poisonous. The first premise that the substance is prussic acid supposes the necessary knowledge for applying to the substance in question those characters of classification which science considers necessary to distinguish it from other substances. In calculation—reasoning of quantity—we perform the same mental operation as in deduction, for in calculating we affirm particular cases from the fundamental axioms of quantity; but we must notice the great difference between the two kinds of derived affirmations, assertions or conclusions: qualitative and quantitative; the former have sensational facts for terms, that is to say, what the mind perceives by its interaction with objects; while the latter have rational relations for terms, that is to say, concepts referring to proportional quantities. These last conclusions are what we call calculations. Calculation being the mental instrument necessary for a complete knowledge of physiological science, and the signification of the word quantity having been erroneously interpreted we must fix, though briefly, the

Concept of quantity. There are two kinds of quantity; discrete and continuous. Discrete quantities are unities and aggregates of unities—abstract numbers—by means of which numerical relations are determined. Continuous quantities are those which represent the extension of objects and the forms of extension. We must not fall into the equivocation of thinking that the two classes of quantity are equal, although the word quantity represents indiscriminately the two kinds of relations here indicated. Number is the only discrete quantity. It is an aggregate or collection of unities, each of which simply represents an abstract act from perception without any determination at all, without taking into consideration the extension or nature of the object. Number, then, is the symbol of quantity, a means purely ideal to compare and measure objects, that is, a standard of comparison between discrete determinations of quantity, in which the unity as well as what is compared with it is considered abstractly and independently. Nevertheless it has been admitted by most mathematicians that continuous quantities are co-ordinate with discrete quantities, considering both similar at bottom, because, they say, they are multiple or aggregate.

The mathematical confusion between discrete and concrete quantities runs parallel with the erroneous identification between the pure conventional forms of thought or of language and objective realities; indeed, most writers have forgotten or ignored the fact that words, being signs of thought, are not directly connected with the things signified, but indirectly by mental agreement. This causes a falling into the erroneous idea that our arbitrary and conventional classification of natural phenomena coincides with real distinctions among them, and that this can be a foundation for inferences on the nature and origin of objects. Such errors have necessarily given rise to a series of false premises which serve only to prevent the true progress of physiological science.

All objects are entirely continuous in perception, this comprehending all data manifested by the senses, and they become discrete only after being submitted to successive acts of perception, thus being partly separated if the perceptions are partial, or co-ordinated with other objects perceived in the same manner forming a whole. No datum of sensation can be discrete in itself, that is, in absolute, because if it were the relativity of objects in the universal system would not be true.

Numbers are but relative unities and collections of such unities, as they represent either single perceptions or groups of perceptions, the contents of the object never being taken into account. Besides, numbers are in abstract essentially entire, though they can represent partial relations, taking their fractional forms; but fractions cannot be considered as numbers or prime unities which express original acts of perception; they only represent objects perceived by parts, which are subordinated in comparison to the whole or entire unity. Hence, numbers are nothing in themselves, they only connect ideas with the objects to which they are applied, and consequently they are essentially abstract; nevertheless, in order to signify anything they must represent some concrete object or relation between objects in particular operations.

We can now see clearly the technical differences between the notions of quality and quantity. In Mathematics (the science which solves the problems of quantity) there is a great difference between an objective concept of thought and the corresponding relation of such a concept with the object itself. Mathematicians are simply occupied with problems of relations either singly or in groups, which reason has established within the limits of arbitrary laws; their concepts are exhausted when all the properties pertaining to the object of thought are included. The conceptual elements of the objects, and the laws of their mutual dependence are determined in Mathematics by pure thought; for this reason a single concept can be developed in a series of others, so forming a mathematical reasoning; one of the attributes implies the others, all being defined in accordance with the calculated relation. Qualitative concepts, on the contrary, are never exhausted, because their united attributes are necessarily incomplete and variable, on account of the infinite perceptions that can be formed in the mind by the most insignificant change in any relations. When we try to establish the points of community or similarity, and of particularity or difference among things which are compared, we can do so either in quality or in quantity in accordance with the two orders of reasoning. The process of thought which infers attributive propositions or propositions of quality is logical reason, that is, the capacity of reflecting on attributions. By antithesis the process of thought which resolves relative propositions or propositions of quantity is mathematical reasoning, that is, the capacity of reflecting on relations properly so called (those of quantity). The meanings of the terms induction and deduction must be circumscribed to the conclusions obtained by inference, which are, of course, qualitative reasonings; while on the other hand, the term calculation must be reserved for the conclusions of quantity.

Inference and calculation together compose the complete process of mental reflection; this is what we call reasoning, which consists in the formation of different judgments in mutual connection in order to establish propositive conclusions as the material of the physiological sciences. Determinations of quantity only and not of quality are acquired by rational applications of general laws; such is the true physiological knowledge, and for this reason it is by Mathematics that the problems of Physiology are to be resolved, in order that this science may reach a perfect development. The extension and comprehension of abstractions, then, vary according to their rank, and the knowledge of the abstractions which characterize a class is what we call concept. Abstractions can be considered either as qualitative or quantitative; in the first case we express a concept of direct perception; in the second, we express a positive scientific knowledge properly so called. Qualitative concepts can only give descriptive definitions, while those that are quantitative can give rise to genesic explanations, in the field of Mechanics, of course, in which all causes are only anterior effects. Only when we cannot determine the relations of space and time among physiological changes we must content ourselves with qualitative determinations which constitute irreflexive perceptions and not true scientific knowledge.

§ 7. VALIDITY OF HYPOTHESES IN PHYSIOLOGICAL THEORY.

The greatest advantage of hypotheses in physiological theory is to help the memory with supposed connections among objects when the sensations of their form of activity are not directly presented to the mind; but although there is no doubt that physiological knowledge is based on sensual appearances, we must not call that knowledge altogether hypothetic.

It is necessary to determine the true conditions and use of a scientific hypothesis, not only in the criterion of its truth, but also in the conditions of its validity. Submitted to logical proofs we must affirm its possibility; and for this it must not be in contradiction with demonstrated principles, and must give full explanation of the idea affirmed by the hypothesis itself. In addition to this, in order that such an explanation should be sufficient, a complete correlation is necessary among the different mutations comprehended in the hypothesis; thus fulfilling the scientific precept that all true knowledge consists in generalizing, by verifying the analogies or differences in order to assimilate many facts in one abstraction.

When we perceive a phenomenon for the first time our investigations aim at knowing to what class it belongs ; this of course involves the idea of system or uniformity in nature. From this we infer that all hypotheses imply a classification, because this is nothing else than the grouping of the cases according to their analogies. Therefore, a hypothetical explanation, in order to be valid, must mark the analogy or identity between the mutation which we propose to comprehend in it and the phenomena which are supposed to be already known by experience. If this prop of the hypothesis is imaginary instead of a fact already observed and rightly interpreted by reason, the hypothesis is valueless ; it is then only a tautological explanation, simply changing the form of expression. Such is the validity of materialism which pretends to explain the activity of nature by saying that "it is inherent to matter as this is always in movement." But material activity and movement are synonymous, both representing mental abstractions and not realities, and so that explanation is only verbal. We say the same of vitalism when it maintains the existence of a vital principle in order to explain vitality. Of precisely the same value is affinity in Chemistry; attraction and repulsion in Physics and Astronomy; and, finally, a mathematician makes but vain deductions, when, starting from an equation alone, he thinks he has established the foundation of physical hypotheses.

In every explanation we must keep in view the course of the acts of thought in which the relations are established, not among the objects themselves, but among their mental representation, *i.e.* among the intellectual elements or different states of consciousness which we have acquired from the sensations arising from the objects. Hence, when we speak of any object or property we mean the results of interaction, either direct or indirect, between the objects and the mind; and as the attributes comprehended in the concept of material things represent in extrinsic realities only their relations of space and time, the number of objects not being limited, the result will be that any of the said concepts will always be reduced to the properties which mark the known relations. Cosmic concepts are indeed limited or incomplete as an indefinite number of objective relations always remain unknown; in fact, in the comparisons we make in order to form material concepts, it is necessary to take into account only a finite number of relations; we need only refer to a number of them, more or less limited, from which we form the abstractions. From this it results that hypothetical judgments and reasonings, not being verified by experience more than in the categorical concept which is limited (but not in the supposition which we try to explain), are liable not only to the double error of defective observation and imperfect reasoning, but also to the error of imagination in what is supposed. Again, the concept which is supposed in a physical hypothesis is not absolutely identical with the categorical concept of comparison, because it is in relation with a limited number of conditions, which are not perceptible abstractions but imaginary ideas, and these we simply try to explain as they are not evident to the eye. For this reason we must not confound imaginary with rational concepts; rational concepts are represented by direct abstractions of objective things, while imaginary concepts consist in the mental application or attribution of such abstractions to some other things, as, for example, when we imagine invisible movements from the concept formed of those which are visible.

The explanatory or fundamental fact of a hypothesis, that is to say, the fact with which we identify the case we try to explain, must be something already proved by experience, because we do not learn anything by endowing the objects with occult principles, as when abstract forces are imagined in order to explain how manifested effects are produced.

The true cause can never be known by experience, and for this reason the primordial or remote cause of the activity of nature cannot be included in Physiology; this studies only phenomena or manifested effects, and the latent material changes which are their immediate cause. By comparing physical changes we infer the general principles of movement—material activity; and the chief use of a physiological hypothesis ought to be the deduction of new cases from those principles, employing in the explanation the same terms applied to observed phenomena, and recognizing the analogy of these with the changes which we desire to explain. But the identification of the hypothetical case with known facts may be at the same time partial and indirect, supposing that there are circumstances yet unobserved in one or in both of the compared terms. Thus a hypothesis may comprehend one or more suppositions if we can prove, or at least if we can see the possibility of its analogy with something really observed; the hypothesis being more probable if the identity is clearly recognized among many phenomena, and still more, if the identity exists among many of the particularities of different phenomena.

Accordingly, a hypothesis makes an imaginary representation, which, in the same manner as works of art, bears a resemblance to, but is not identical with things observed or realities existing in nature. Consequently there will be some points of similarity and difference between hypothetic and categoric knowledge, as there are between a statue and what it represents. Thus, for instance, when we infer the invisible movements of imponderable matter from those which are visible we express an analogy of form; but as the material is different in each case the activities of the two terms cannot be identical in all, but only in part. When we imagine new forms of existence we change the combinations, or, by analogy, the sensible properties, because we can represent something in our mind only by means of those data given by experience, as our physiological or natural ideas are formed by sensation. It is necessary at least in order to acquire the character of possibility that a hypothesis should not be contradictory either in its own terms, or with the facts which our rational experience has recognized as true.

We have said that a hypothesis is more or less probable according to the cases of coincidence offered to our observation; but besides this it needs the successive confirmation or attestation of new facts, because it is clearly seen that it will become less and less probable if the new facts cannot be explained without increasing or modifying the first hypothetical proposition, and, on the contrary, the hypothesis will acquire so much more value according as a greater number of facts arise to attest its primordial affirmation. In the same manner, if, by means of reason alone, we discover deductions that can afterwards be tested by experience, it will increase our certainty more and more in favour of a hypothesis. Nevertheless, the value of such predictions must not be exaggerated, because they often arise from very indirect relations, and are without direct connection with what we try to explain; these coincidences are due to the uniformity of the system. We see, indeed, that all the hypotheses that have been abandoned as contradictory or insufficient have helped human thought to foretell phenomena which have been afterwards observed, because if a false hypothesis has explained many phenomena, it is not strange to prognosticate from it others in more or less relation with those for which the hypothesis was imagined.

The validity of a hypothesis because it is conceivable has been very much discussed, and this question has been generally confounded with the following whose resolution is entirely metaphysical. Is all that is conceivable true, and the reverse? It is an evident criterion of truth in physical propositions that the contradictory proposition must be inconceivable, though on metaphysical grounds our incapacity to conceive a thing is not a proof of its impossibility. All true physiological conception consists in establishing relations of identity between the case which our imagination must conceive and the facts known by rational experience ; therefore, in order that a physiological hypothesis should be conceivable, it must identify itself with the ideas previously known, and must have no contradictory terms.

In regard to the previous concepts, it is necessary to distinguish them as categorical and hypothetical, because in the last there is the possibility of their being untrue, otherwise we should then assert as a truth an idea in contradiction with those that were before hypothetically maintained. The inconceivability of a case in nature can be admitted only by disagreement with notions which, though not completely and evidently proved, are supposed to be very probable. All the inferior concepts regarding the object are comprehended in some superior one, and therefore the validity of a physiological hypothesis requires mutual agreement among the concepts of different rank which is a guarantee of certainty. Nevertheless, scientific progress constantly rectifies ideas previously admitted as true.

The false supposition of wrong hypotheses generally depends on the ontological error which considers mental entities as separate or independent realities, though they are only concepts of one or many abstractions. Thus, objects are frequently considered as existing independent of their relations, and *vice versâ ;* and the modes of forming concepts are also erroneously considered as constituents of nature. All this, as we shall see now, is what happens with the mistaken hypotheses of the doctrines called mechanism, materialism, evolutionism, idealism, and pantheism.

§ 8. BRIEF CRITICISM OF REALISM, ECLECTICISM, SCEPTICISM, AND EMPIRICISM.

Realism considers as entities or beings of separate existence the concepts and even the conceptual elements which are formed by mental abstraction from our external experiences. Thus, also, it is realistic to consider as separate existences every one of the different kinds of phenomena, as caloric, luminous, magnetic, and electric agents, molecular forces, planetary attractions, etc.

[In Psychological Theory this error is also frequently found, namely, that of individualizing as realities the different conscious activities, and from this results the general admission of plurality instead of unity in our mental power.]

There is nothing absolute in nature; or, better to say, our understanding does not and cannot know physical unity, entity, or type in absolute, either of quality or of quantity; there is no absolute material substance, no absolute activity, no absolute space, and no absolute time. We do not *objectively* recognize anything which may be an absolute cause or principle; all that is physiological (nature) is an effect or medium. Every form of material existence suffers perpetual changes, undergoes incessant mutations which are not primordial, but derived by propagation. Manifested existence depends on mutual action among objects, and on the interaction of these with the mind from which we form the relations of the objects, and consequently all their possible knowledge. Although this is an evident truth, the greatest minds occupied in scientific speculations forget it when they suppose the ultimate elements or real constituents of the world, atoms, monads, etc., are absolute realities. Atoms are erroneously considered absolutely simple and indivisible as if they were the last elements of the material world —the physical unities absolutely constant which by their aggregation form the universe.

The operations of language are comparison, discrimination, and reasoning. When the capacity for classification is lacking, there cannot be rational language, as for this are necessary—first, a multitude of experiences; second, abstraction of the common element forming a unity; third, formation of a term for such a common element; and fourth, application of the same term or name to all the individuals of the group which gave rise to the common element. For this reason in the root of every noun we find some abstract signification of the most prominent character of the thing which it represents, and such a character (abstraction) becomes the concrete sign of that thing. Thus language gives us the tendency to fall into realism.

Language has a double function; it is the extrinsic communication of thought, and it is also its intrinsic reflection; in this case it shortens the work of thought extraordinarily, and it may be said that without language neither thought nor knowledge could make any progress. In the same manner as a word always expresses the result of an abstraction and generalization, abstractions and generalizations could not fix themselves in the mind without words, but would disappear from it as soon as the moment of sensation passed. Moreover, he who studies a language finds a wealth of knowledge for the elaboration of which the activity of many persons has been necessary. But although language enables thought to accumulate its products and abbreviate its process, it is also frequently the motive of errors such as thos of realism, which we may say are a consequence o a bad interpretation of language, confounding name with the things themselves, and giving a real significatio to that which is purely an ideal concept. To avoid this mistake thought with sharp criticism must keep a constant watch over language so that it may serve as an instrument fit for its purpose, and not allow us to fall into absurd equivocations.

Let us, then, keep in mind that the most disturbing element of the criterion of truth in science is defective and false language, because, as the elements of thought can be differently combined in perception, any fault or impropriety in association of ideas, and in the terms which represent them, or in any other mental connection may lead to error. We must be especially cautious in the use of equivocal terms, and avoid realistic technicism, which leads us into the error of considering as real existences the abstract ideas of quality and quantity.

Hence it is an absurdity when philosophers impose on the mind work which goes beyond the limit of its conceptions, comparing these with reality; for reality cannot be known in itself but only as it appears to our mind. For this reason the ultimate proof of our knowledge must be the signification contained in words, not direct realities, but ideas which we have or which we form about them. Such a proof of what knowledge contains will consist in the suitable evidence or necessity of the conception and in the harmony of our conceptions among themselves. That is to say, at the end of our investigations we arrive at concepts that cannot be proved by reasoning, or communicated by language; every subject must acquire them by himself, and consequently if such concepts are to be explained in any manner it can only be done by means of synonymous expressions. Such ultimate propositions are the foundation of theoretical science. Accordingly, in realism, as in all false doctrines, we find the same cause of error which probably originates in confusion or misinterpretation of the terms employed, because they contradict the following evident principle: the definite cannot be derived from the indefinite, as a definite conclusion can never be inferred from indefinite premises; the indefinite is the basis of and leads to nothing, it is in itself nothing, and from nothing nothing can come.

Eclecticism. The actual world manifests harmonic plurality in all parts; constant intercourse taking place in nature where gains and losses occur uniformly in direct succession. Therefore we cannot consider the world as a conjunction of unitary and immutable things, unless, following the *eclectics*, we force our belief against the true existence of objects by considering all the phenomenal world as a complete illusion. But to consider object as mere illusion is an idea incompatible with all the fundamental principles of Philosophy, and conduces to the negation of all knowledge; besides, if every object were one and immutable, how could the illusion of the plurality and changes of things ever take place in our mind?

Scepticism can be recognized only when a careful and complete analysis and definition of a point or question cannot control the discordance and contradiction in our mind. But even *sceptics* admit the priority of some knowledge, they presuppose continuity of space in reality, that is, immediate contact among things in order that the action of one should directly affect the other; and they admit the validity of the universal laws of thought—those of identity and contradiction. But if they accept these principles they must also accept their consequences. So we must now state the ultimate evident truths and their necessary conclusions in order to prove the falsity of *scepticism*.

Among intrinsic intuitions there are some which are first principles, not derived but necessary as self-evident truths, and which are in the same case as our ultimate thoughts, that is, in the same case as are the supreme principles of reflection—limit of the intelligence. Such principles cannot be explained, in truth there are no words by which we can comprehend them, and for this reason they cannot be known if not directly perceived by our own intelligence or understanding.

The terms which express intuitions and ultimate thoughts constitute the principles of scientific language, they being the foundation of propositions, and hence of inferences and calculations. Let us first see the basis of thought and language which represents the immediate reaction of the mental subject. The first intrinsic intuitions are the affirmation of our own *subjective existence*, and the consciousness of its activity as it is revealed to us by the emotions of pleasure and pain. The first extrinsic perceptions are the affirmation of a world of objects which exist outside of our mind, and the activity of such objects in order that they may incite sensations. We must remember that neither intrinsic intuitions nor extrinsic perceptions produce mature perceptions until they have become food for thought, and for this reason they are postponed to the following principles which are the first axioms of discursive language—the laws of thought.

We admit and recognize a general assertion as a fundamental law of language, which is called the principle of contradiction; according to this what we affirm of one thing we cannot affirm of the contrary, as its negation is implied in its enunciation. To this principle is united that of consistency resulting from the synonymous or tautological forms of language, which permit us to affirm the same thing in different ways; and this is the only resource we have for the definition of ultimate terms because they cannot be explained or defined by means of true propositions.

We admit and recognize also three fundamental principles of mental reflection. One refers to the comparisons of quality, and for this reason it must be considered as the universal assertion of attribution; this is that *nature is uniform in its activity*, which implies a law of causation in the universe and not chaos. The other two principles refer to the comparisons of quantity, and consequently we must consider them as the fundamental axioms of cosmic relations or physiological knowledge. Such are, first, that quantity is equal in different relations if it is equal in any two of them—that is, if they are compared two by two the result is equal; and second, the sums of equal quantities are also equal among themselves. From these two ultimate principles we derive all the axioms and rules that govern calculation or mathematical language, by means of which we can discover the scientific connections of objects in their continuous changes of space and time.

Accordingly, the main guide of mental elaboration for the physiologist is to be found in mathematics, as pure logic is the sole guide for the metaphysician; logic being circumscribed to the art of guiding us in qualitative reasoning; that is, to the different states c consciousness by which we elevate our ideas to super sensual regions: Mind and Supreme Being.

Empiricism. By observation we acquire one by one abstract perceptions only, so experience in this sense is exclusively analytical. But reason works, not only in analytic mental operations, but also in synthetic, and must besides necessarily reflect even on the first experiences in order to elaborate knowledge; therefore the so-called empirical laws of nature cannot be said to emanate directly from the senses. A theory is judged by reason and not by the senses, as the jurisdiction of these can only serve to accumulate ideas which are afterwards elaborated as scientific by means of the generalizations of reasoning.

Strictly speaking, *empiricism* means that some facts in mutual connection have been discovered without a knowledge of the reason of such a connection. In this sense empiricism simply asserts that we do not know everything; but this is so trivial a statement that there is no need of upholding schools in order to maintain it.

According to the most ordinary signification, *empiricism* means to assert that we are satisfied within the limit of our sensual experience, forgetting calculations and scientific inferences. But this does not satisfy the most insignificant thinker, even though he should call himself an empiric; every one feels impulsed to follow more or less closely the current of progressive science, which treats of the discovery of the correlation that necessarily exists between the infinite variety of facts and the unity of principle; and this can be sufficiently proved in order to be recognized and adopted. Notwithstanding this, there are different personal degrees of mental satisfaction, and from this a variety of opinions arises on this point, all more or less empirical and yet none empirical in absolute.

With the universal conception that all the facts of relation (that is to say, the mechanical or physiological) are at bottom matter in movement, we can explain all kinds of activity discovered by the senses, those extrinsic means of existence which constitute the inorganic world, as well as the phenomena of living beings which constitute the organized world. Such an assertion can be derived by pure reasoning, because a calculation on quantity is an elaborate reflection on relative propositions which our intelligence can make *a priori*, without any experimental proof of the resulting conclusions. In this manner the simple determinations of space and time are acquired, and so also are the quantitative compound determinations of mass, velocity, and force. In all these notions of abstract quantity, which are determined by means of Mathematics, the relations can be known as evident though they are obtained by pure reason.

§ 9. BRIEF CRITICISM OF MONISM, PANTHEISM, IDEALISM, MATERIALISM, TRANSFORMISM, AND ATOMISM.

All philosophical doctrines that are of any consequence can be grouped under two denominations—*Monism* and *Deism*. The doctrines which refer all things and changes to a single ultimate constituent are monistic. True Deism is neither Monism nor Dualism; it does not recognize two principles as Dualism, nor only one common essence as Monism does; it admits a principle or Creator, and a consequence—things created (rational and irrational).

There are three chief kinds of Monism; the materialistic monism of the transformists; the idealistic monism of Fichte and Schopenhauer; and the pantheistic monism of Spinoza. All monistic doctrines consider as unity all and every one of the parts of the universe, that is to say, the conceptual element of ultimate generalization — primitive atoms, monads, nebulae, mental spirit, essential substance, or something unknowable and capable of a triple aspect, objective (material), subjective (mental) and omnipotent at the same time. To-day most monists explain the universe as a sum with different degrees of aggroupation, forming the atom in the inorganic ground, and the cellule in the organic, and they consider the monad as the common element. Thus the monists see the atom as a corpuscle with its own action, all the phenomena of bodies depending on the sum of their atomic activities, and they say that cellules live, each one by itself with an autonomy whose synergetic or co-operating manifestations constitute among them the apparent unity of life in superior beings. That is to say, they consider atomic and cellular elements as personalities which work automatically with pre-established harmony in the common work of the republic which they constitute after this conglomerate fashion. For the monist the organism is born, develops, and acts because the special attribute of life is inherent to it, embodying in itself the cause and effect of its activity; so Monism admits that the first organic creation was produced by itself without anything aggregating or concurring to give it activity; that is, monists do not see in living bodies anything more than the proper conditions of matter. Vitality, then, which is a potential and phenomenal synthesis, would in such a case be a primordial causal activity of matter, and not the effect of something else.

Monism involves Transformism, and, of course, Atheism, either materialistic, or idealistic, or else pantheistic; it implies at the same time spontaneity, automatism, or specific attribution; all this is evidently anti-scientific, and the monists themselves abnegate its admission on principle, although they have fallen into the consequences of such errors. It cannot be admitted in absolute that there is an effect without a cause, or a consequent without an antecedent; nevertheless the monistic doctrine does not recognize in the cellule more power than the resultant of the sum of atomic unities, which the monists simply consider either as ultimate elements or as a conglomeration of monads. But mechanical power, that is, the power of which those particles are capable, is reduced to the formula $r < f$ (manifest resultant is less than the loss of living force). Whence, then, comes the vital or generating power whose formula in Cosmos is $r > f$, that is to say, the resultant greater than the force employed? If we try to explain this by the sum of material elements, there is no other way than the implication of spontaneity, automatism or specific properties in matter. This is evidently mathematical, and, strange contradiction, contemporaneous monists recognize with great ardour the principle of conservation according to which the cosmic formula is $R = F$, that is, the whole resultant (potential and phenomenal) equal to the force employed, and base it on true, positive, experimental proofs, though this, rightly interpreted, is contradictory to their doctrine.

We will see that the spontaneity of certain changes is only apparent. It is very common in inorganic matter, and constantly occurring in organic, that in order to produce changes it is enough to provoke them without the concurrence of a determined or efficient exterior cause, because the body in which the changes operate previously contained sufficient conditions to produce phenomena or functions by the influence of a living energy much less manifest than the consequence. As patent examples we may take the explosion of gunpowder, or the development of a chicken in an egg. The force which is then made manifest had been before accumulated in a latent state.

Neither living nor inorganic bodies can be formed by an evolution of simple propagation from a monadic, primitive constitution of the universe in self-transformation, without any more than the first created impulse. In living bodies there is no simple propagation ; there is a multiplication in the individual and in the species, and therefore, in order to avoid falling into palpable contradictions, we must admit that all the changes of existence obey an engendered evolution and not a simple transformation. In such generation nothing is newly created, but all changes become manifest in their origin by converting latent energy into phenomena when organic constructions are developed ; which is an act contrary to those of mechanism. In the incubation of eggs, for instance, we already see a great gain of living energy, because chickens are formed simply by keeping eggs at the same temperature. The result of such a change in organism is completely contrary to that which takes place in any inorganic machine.

Mechanicians are monists when they do not recognize in the universe anything but the existence of movement. Physicists fall into the same error when they elevate the abstract idea of the unity of force to the rank of unique reality. Chemists are monists in supposing atomic unity. Monism has also intruded into Biology as an effect of the mistakes of some analytical speculations, by considering as an ultimate causing principle that which is the end or finality in the succession of the acts of nature, and conceiving vital synthesis as a real independent existence; from this error arise the schools of transformism of organic evolution which pretend to see the reason of change in matter alone.

Materialism completely inverts the order of reality, because simple abstractions, that is to say, those which offer the most elevated, most general, and most comprehensive concepts, and which are the ultimate principles, are considered by them, not only as the first concepts, but also as the most realistic of all the forms of existing things. Such an error arises from the false supposition that the general abstraction of all things constitutes their common substance as a permanent substratum, aggregating to this the attributes and particular properties by which objects are differentiated, so that, according to such a supposition, subjective realities are considered as an aggregate of substance and energy, essence and accidents, matter and force, or mass and movement; but if such elements are not realities, no real object can be produced by their union. Materialism supposes substance as a union of passive, resistant and unalterable particles (atomic unities); and considers energy as an active force equally unalterable, to which the advocates of this theory attribute all phenomena.

Evolutionism or *transformism*, like materialism, supposes that the real objective forms are contained or implied in the superior forms or ultimate concepts, the former being derived from the latter by an inherent process of evolution or development, asserting that a constant quantity of force naturally belongs to every part of matter, and that all transformations are produced by a simple differentiation in such primordial force. Matter, according to this doctrine, is endowed with the power of the Primordial Cause (God), engendering by itself the activity of nature, as all differing existing realities and all forms of energy, including vitality, would then be potentially contained in matter, successively manifesting themselves by a kind of natural emanation in a spontaneous, gradual development of ulterior evolution. When transformists say that matter incloses or implies in its own origin the forms and qualities of life, containing them potentially at least, if not actually, in order that they should be engendered by a spontaneous development, they do no more than use the qualification of *potence* as a shield for ignorance of the cause, and thus persuade themselves that they can deny the purpose and finality of the Cause which directs the system of the universe. We will see in the last chapter of this book, that the formula of *evolution* is to reduce all the states of actual manifestation to one having the power of becoming manifest; thus transformism pretends to conceive the universe in some state anterior to the phenomenal, without explaining anything of the engendering of matter or objective reality in which phenomena are manifestly produced by simple propagation or transference of movement.

The errors of evolutionism have conduced to nihilism, according to which all is engendered by "the void," that is, by nothing, or by a pure substance completely devoid of attributes; scientific nihilism expressly declares that such a substance cannot be distinguished from nothing, and consequently is identical with it; thus pretending to deduce the phenomenal world from the supposed concept of nothing, *i.e.* zero. The substantial nothing, as an origin of all existing things, has been also expressed in another manner, by supposing that the germinal principle is an impersonal will, which, being contradictory in its own expressed attributes, will also result in an empty concept, *i.e.* non-existence or nothing.

Atomism (that of the Greek atomists, as well as of their followers, the modern physicists) has also failed to observe the conditions of the problem regarding the common existence of a pure being in nature, since it considers atoms as the sole realities, endowed with self-existence and complete independence. Such an idea is taken entirely from the illusions of sensual or irreflexive experience, and it is a contradiction with the most rational inference according to which objects necessarily constitute a true system in the universe. If objects were independent, that is to say, if they could exist indifferent to one another, and so without mutual relation, how could we explain the actions and dependences which we observe in the actual world? It would be impossible to explain them, because individual independence excludes community, which is necessary in a system of things mutually related. With such an atomic conception of matter, the theory advanced by most authors up to the present time becomes useless for the purpose of physiological science, which must distinguish natural changes into phenomenal and latent; the former are the changes which are extrinsically manifested to us by means of the senses; and the latter are the changes which are not manifested, but which explain the propagation of movement in the acts of loss and reparation of living energy or phenomenal force.

It is an evident necessity to conceive matter in such a manner that we can clearly explain all that is manifested in the universe, and these changes being defined and determined, the atom or corporeal element cannot be a thing undefined or undetermined. Again, we say it is an evident truth that one thing cannot be primarily considered as indefinite and afterwards as an object of definite determinations; it is a self-evident truth that the definite can proceed only from the definite, and that the indefinite (not confounding this with the undefinable or illimitable—that which is beyond the reach of our mind) cannot produce anything intelligible. It is as impossible to deduce the definite from the indefinite as to obtain movement from repose, or a being out of nothing.

No argument is necessary to prove this self-assertion; to grasp it we need only understand the terms which are employed. Nevertheless, many thinkers, and among them perhaps the most notable among our contemporary physicists, uphold the idea that matter is constituted by centres of indefinite action which are without extension and are supposed to be endowed with influence acting at a distance in a spherical space that must of course have some extension. This is untenable —still more, it is incomprehensible, and can only be admitted as an unknown quantity—an "x" in the speculative process of calculation on physical phenomena. Hence, it is an unresolved problem, as those who uphold the theory under notice start with an imaginary phrase to represent the atom when they consider it as a mathematical point—without length, breadth, or thickness.

The false universal notion of common being is nothing more than the result of the pernicious influence of the erroneous doctrines of the ancient Greeks and scholastics with their distinction between matter and form, as the supposed infinite substance of Spinoza; the absolute being of Schelling; and the absolute idea of Hegel. The last three are *old* abstractions expressed in new words.

Nature cannot be conceived as definite in itself, for we cannot refer to it nor form an estimate of it, save by our purposes and perceptions. But the current theories of nature are built on the false base of the abstraction of *being* as indefinite and immutable, admitting abstract forces in nature, which, they say, act, determining and changing the conditions of *being*. The doctrine of Cosmogony according to Spencer, Darwin, Haeckel, etc., is equal at bottom to the idealism of Hegel, to the pantheism of Schelling and Spinoza, and to the ancient speculations of Platonism which imagine things as the product of the union of the idea with indefinite existence; and, finally, it is also identical with the scholasticism which used to give the name "form" to such ideas as those which we directly discover by sensual or extrinsic observations.

The conceptual elements of objective being or real nature are four: two are attributive abstractions—substance and activity (abstractions of an entity in itself);

and the other two are relative abstractions—space and time (abstraction of different entities among themselves). When an entity is not defined its four abstractions are also indefinite, and from this arises chimerical, ontological concepts; and when the entity is defined by our sensual observation or experience, then the four elemental abstractions are also defined, and from this arise true physiological concepts. When this distinction is not well established, the metaphysician, influenced by ontological errors, leans to pantheism and idealism; and for the same reason the physicist or naturalist usually falls into atomism, atheism, and materialism. If these abstractions in regard to the Infinite Being are confounded with the finite, we then fall into the error of considering them as really existing, not in the Divinity, but in themselves; and if the abstractions regarding the finite being or nature are considered as exclusive existences, the result is the false supposition that matter is in itself alone the only principle of the universe, and nature then should be governed by itself alone, as is the idea of atomism.

Therefore, we must proclaim monotheism in science, thus proving our agreement with religion in the belief in only one true God as the Causal Unity of the Universe, and reject all abstract or causing forces in nature.

§ 10. PROVINCE OF GENERAL PHYSIOLOGY.

The supreme principles of Philosophy offer two different concepts; one unlimited, indefinite, intrinsic to thought alone; the other limited, definite, and extrinsic, being within the reach of our senses. The first concept, which is purely subjective, is metaphysical, and the second, which is objective, is physical or physiological, this last word signifying what is perceptible in the material world, or what is commonly called Nature; this alone is within the province of Physiology.

The starting-point of thought in following the process of mental *elaboration* is the comparison of sensations, and these are of two kinds, intrinsic (subjective) and extrinsic (objective). The assertion is completely different in accordance with the class of premises of thought; the assertions of intrinsic sensations or intuitions are purely mental (immaterial, spiritual, metaphysical knowledge), while the truths inferred from extrinsic sensation, though taking intuitions as a base, are material, that is to say, physiological knowledge. To metaphysical knowledge the mental *ego* has in itself an exclusive right, as nobody but one's self can directly perceive the acts of self-consciousness. On the contrary, the limit of physiological or natural knowledge, that is to say, of the knowledge about extrinsic or objective things, is experience; so that nature or object is equally common to the observation of all minds, *i.e.* the perception of its changes is the common right of everybody.

We have adopted the title, "Universal Physiology," to comprehend the whole *abstract knowledge* of material nature or physical *cosmos;* its province, then, is the conceptual analysis and synthesis of Cosmic Mechanism, unifying all the theories of Physics, Chemistry, and Biology. We have divided Universal Physiology into General and Special, and subdivided each of these departments into analytical and synthetical; all comprehending nature in the *abstract* sense. Cosmos is effectually an organic system whose special analysis has been the subject of our work, "Theory of Physics," and whose special but partial synthesis is the subject of "Abstract Biology;" our "General Physiology," then, must occupy itself with the study of the abstract analysis and synthesis of Cosmic Mechanism in its most comprehensive ideas, without taking into consideration the knowledge of every special change.

Mechanism is not a thing really independent; it is the concept of an abstraction from objective or material nature, making the elision of the Primordial Cause. We cannot explain the creation of matter, nor the primordial determination or generation of manifested or living change in organism; but we may refer to the subject of vitality and say that it is the Supreme Power, and not a transference from mechanical energy, because this does not suppose anything more than matter in movement under the different forms of secondary activity. The proofs of this assertion are the impossibility of affirming the contrary, and the principle of conservation.

The uniformity in the order of the universe compels us to admit that it is an organized system, for which we must recognize an Organizer whose power is not directly manifested in any form of matter save organisms. Hence, God as Organizer is the principle of vitality—that is to say, vitality must be considered as the only activity really originated, and such primordially derived unity is the proximate cause of phenomenal motion in cosmos. This idea must take the place of that host of abstract forces admitted by authors as exciting the world to action. Physico-chemical forces are only the result of movements; they are not causes, and still less can they have the conditions of intelligence necessary to accomplish the determined principle and final aim of the system.

.The prime influence which governs living bodies is a perpetual miracle, and the only one of this kind constant in the world; we can only know it by the continuous effects it originates in organism—first in imponderable material or progene, and secondly in the continual transference of ponderable matter in and among different bodies. In nature there will always remain this eternal mystery to us: the continual creation of phenomenal activity in organism, which is revealed to us under two forms—generation of new beings or multiplication, and growth or development of living beings. The other changes of nature exist in a continuous succession, keeping reciprocal equivalence among themselves, and can be perfectly explained as consequences of vitality; while the reverse we have proved is an impossibility.

Physiology occupies itself in acquiring the knowledge of what is extrinsically manifested, and of that which, although latent, is directly derived from phenomena, the differences in the material world not being absolute or essential, but formal; that is to say, they are quantitative differences more or less, either in the numerical measure of physical energy, or in the geometrical measure of extension.

Objects are only known by the perception of the relations among themselves, and among such relative differences our mind discovers an exact correlation among the same objective changes when their succession is inverted, and such a correlation is nothing more than the fact or law of conservation of physical energy, including in this, not only manifested, but also latent energy. We have already said that in all relations there is a common standard of comparison; this is quantity; and the conservation of the same energy is the reason of the unity of the material system, abstracting from it the Primordial Cause, that is to say, considering the world in its derived activities as a mechanism. Accordingly, Physiology in the sense of Universal Mechanics is a science treating only of motion which produces effects manifested to the senses, or, in other words, that which has movement as form of activity and which constitutes the material or natural object.

In Physiology (comprehending the whole science of nature) it must not be forgotten that the object pursued is partial; that this science does not comprehend all knowledge, and therefore must not deny the existence of those sciences which treat of that which is beyond our extrinsic sensations, and that the inquiry into Metaphysics (Theology and Subjective Psychology) is of quite a different order from the inquiry into Physiology. Any sensation implies the perception of a difference among all manifested things, for uniformity in perception in a practical sense is equal to absolute lack of sensation. Without a change in the perceptions, no phenomena whatever could be made manifest to us; we must at least experience the distinction between something that exists and nothing. Every different act of perception excites a special act of consciousness, and the mind refers it to something existing outside of itself, and considers it as a qualitative attribute of the thing referred to. Further, we have the consciousness of the special sense by means of which we appreciate phenomena, and from this arises a distinction of classes, or, better to say, a certain analogy between all the perceptions acquired by the same sense, considering them as a similar class of qualities. The nerve does not transmit the object of sensation; it only propagates the movement produced by direct or indirect interaction between the object and the organ of sense; and consequently the differences in the qualities (from which attributive differences arise) depend on the arithmetical factors of the propagating movement. For this reason attributions or qualities are subjective or ideal differences, not objective or real ones, because the last are what we acquire by reflecting on the basis of experience, referring the sensations to their objects; and by quantitative comparison between natural changes or physical mutations we arrive at the knowledge of their arithmetical factors. Thus, although objects are perceived as different, reason recognizes some identity among them, *i.e.* all objects or things manifested by means of the senses are constituted by matter in movement. This great induction is another reason of the unity of the sciences which, taken together, we name Physiology.

The various phenomena (physical and chemical) with which physiological sciences are occupied have an intimate correlation in the system, one determining another in very different ways. If the degree of mutual dependence in nature could be exactly known, and a perfect conceptual analysis of the phenomena could be determined, Physiology—the complete study of nature—would become a science as deductive as Geometry, and on this depends the preponderance of Mathematics in Physiology. This science is constantly working towards that progress, but so slowly that in our day we cannot expect to see it arrive at any practical degree of perfection; and, besides, we have the contrariety that the number of properties which are daily discovered in bodies are becoming considerable at the same time that we know nature better, and also know more about the mutual dependence among properties already discovered.

There is another set of questions which is beyond the sphere of our natural knowledge; such are: Where does matter come from? Why does it move? How is the connection between the Immaterial Principle and matter effected? What is the cause of the uniformity and continuity of natural evolution? For what reason is change originated, in living bodies alone, and propagated throughout all the world?

These inquiries are not within our limits, their discussion belongs to Immaterial Philosophy or Metaphysics, as in them we ask for knowledge about the Creator, and the connection of the Creator with things created. This miraculous connection is the incomprehensible cause of the function of organism, and therefore of all the phenomena of cosmos. Hence the more immediate or direct effect of the Primordial Motor upon nature is vitality, which is the synthesis of all the changes taking place in both kinds of living individuals—in the vegetable and in the animal kingdom.

The limits of physiological knowledge are the unknowable or infinite qualities; *i.e.* problems of Metaphysics which comprehend the generation of the mental and of the organic process. These, evidently, can never be included in the material circle of Physiology.

Some doctrinaires maintain that our understanding cannot reach the knowledge of any more in the universe than of that which refers to matter in movement. This only shows the narrow limits of their ultra-positive satisfaction, but it does not prove that the universe is constituted only by what is manifested to our senses, and in making such an affirmation they put themselves in palpable contradiction to what is discovered by our rational capacity superior to irreflexive experience. Everything in the world conduces to the belief that a Supernatural Power acts upon living bodies as the true or real Causing Force which is the antecedent and cannot be the resultant of their organization ; so that all the phenomena or manifested changes of nature are secondarily derived from vitality which is the sole proximate effect in the world of the sole and true cause. Hence, we must admit a God, not only as an agent or principle—Creating Cause—but as an agent of evolution—Governing Cause ; and in such a supreme principle we must recognize the divine finality which must immediately direct the primordial effects of nature, these are those of vitality or living generation—immediate cause of all phenomena in the universe.

We must explain to ourselves the universal law of conservation of energy by considering the genesic potence one and the same for all bodies, producing different effects according to the invariable conditions of the universal whole in quality and quantity ; that is to say, such a primordial potence is obedient to its own principle, it creates in relation with its power. This potence, being perfect, cannot be conceived either as defective or exuberant; it cannot create more, nor can there ever be less than what it has created ; therefore the cause (Creator) and the result (matter) can neither increase nor diminish, that is, there is no new creation nor annihilation. Matter experiences metamorphoses or evolutions, but the potence will be always essentially the same, changing only the form and combined con tution of its resultant—actual world in involution.

Accordingly, the first fundamental idea of Physiological Theory is to proclaim scientific Mo theism in the place of Materialism, which, with atoms and multiple abstract forces is a real idola and finally, also, in the place of the incredulity Empiricism, which pretends to be scientific with theories.

PART I.

ANALYSIS OF COSMOS: ANALYTICAL CONCEPT OF MATTER.

CHAPTER I.

GENERAL CONCEPT OF MATTER: (A) ULTIMATE ABSTRACTIONS OR CONCEPTUAL ELEMENTS OF MATTER.

§ 11. Brief definition of the four elemental concepts of matter—§ 12. Concept of *substance* explained—§ 13. Concept of *activity* explained—§ 14. Concept of *space* explained—§ 15. Concept of *time* explained—§ 16. Real or concrete concept of *movement*.

§ 11. BRIEF DEFINITION OF THE FOUR CONCEPTUAL ELEMENTS OF MATTER.

The simplest notions of the understanding, *i.e.* the fundamental or elemental concepts—classes of ultimate abstractions—are complementary ideas, which, in order to express knowledge, or even suppositions, must be combined in themselves, for they are nothing in reality if considered apart from one another; if their signification is complementary their validity is only ideal, as by composition alone can they enunciate real truths. Simple conceptions, then, are distinguished from propositions; the last are complete ideas or speeches by which we express either knowledge or suppositions; the first are necessities for thought to express the truths from which we are enabled to make our reflections, that is, inductions or generalizations, and deductions or definite determinations which are derived by the application of the general truth of an induction to particular cases.

Natural science contains at bottom some conceptions that are but suppositions concerning the connection of material changes; yet such connections, although self-evident truths, are not at all perceived by our senses. Thus, for instance, we suppose *substance* as the supporter of material changes, and we take it for granted that *activity* is the interchange of substance. We also assume *things existing in space* as the extension they must occupy; and *time* as the duration of some change. None of these four fundamental conceptions of material things—"substance," "activity," "space," and "time"—are objects or things of immediate perception; they are, of course, only theoretical or speculative ideas, but they are indispensable to the so-called positive knowledge of nature or physiological propositions, because these could not even be conceived without the connection among such elemental ideas. Now, these simple conceptions, being necessarily used in every scientific proposition, must be known in their true signification, in order to avoid in Physiology erroneous suppositions of the causal connection of natural phenomena. Thus, for instance, when we say, according to irreflexive observation, that light is of many colours, we only suppose colour as an attribute of light; but in studying the real meaning of attributive conceptions concerning objects we learn that there is no possible difference in the quality or essence of substance and of natural activity, and that all objective differences are relative, that is, in the connections of space and time. So we may affirm, after our principles of investigation have been rightly interpreted by reflexive thought, that if two lights differ in colour that difference is only relative, and consequently, colour can be essentially affirmed as a relation and not as an essential or qualitative connection—attribution. This argument is applicable to all and every one of the judgments concerning objective knowledge when subjects and predicates are simply combined as substantives and their qualitative attributes, and in this way we see that thought constantly rectifies the ideas acquired by immediate or irreflexive experience. Always bear in mind that in simple conceptions we have only the elements necessary for thought to reach the fundamental proposition of Physiology, not by deduction but only by generalization or induction of the fact of inertia, with the sole guarantee of our belief in the uniformity of nature, because anything to the contrary is inconceivable and contradictory to the most insignificant affirmation of scientific knowledge.

We have mentioned two universal intuitions; one is *substance*, which is the nominal attributive; the other is *activity*, which is the real attribute. When we reflect upon these intuitions we either infer subjective ideas—qualities; or we calculate objective ideas—quantities. These last are reduced to two classes of terms—*space* and *time*, which, as we shall see, are products of mental reflection and not mere intuitions.

Hence the conceptual elements or concepts of matter are *Substance*, *Activity*, *Space*, and *Time*. The word *substance* is the conceptual term for the ultimate abstraction of all the attributions that can be a subject in a grammatical or nominal sense. The word *activity* is the conceptual term for the ultimate abstraction of all predicate attributions. The word *space* is the conceptual term for the ultimate abstraction of all the relations of extension and distance. And the word *time* is the conceptual term for the ultimate abstraction of all the relations of duration.

We must clearly fix the meaning of these four terms, as many doctrinal errors arise from some ontological interpretations. Limiting their scientific signification to their cosmic or physiological concept, according to which they are the ultimate abstractions from extrinsic or cosmic perceptions (not extending it to their absolute comprehension as universal or metaphysic), we will still further define the expressed terms in the following manner :—

1. Cosmic *substance* (that is, in the material or physiological sense) is the nominal notion common to all objects, that is to say, to all things perceived by the senses, abstraction being made of activity, space, and time.

2. Cosmic *activity* (that is, in the material or physiological sense) is the general notion of the attributive predicate applied to all objects ; that is, movement, abstraction being made of substance, space, and time.

3. Cosmic *space* is the *extension* of matter, abstraction being made of substance, activity, and time.

4. Cosmic *time* is the *duration* of a part, or of the whole of the material system, abstraction being made of substance, activity and space.

According to the definitions here given we classify ultimate abstractions as attributive and relative. Substance and Activity are attributive; Space and Time are relative. We call the first two attributive abstractions, because they are referred to matter itself, and their conception can be made separately in every object; when a comparison is supposed purely in substance or activity, without making reference to the relations of space and time among the objects, it is not quantitative, it is merely qualitative or attributive. On the contrary, Space and Time we have denominated relative abstractions, because they are conceived, not in matter itself, but in the comparison of two states of consciousness that are different in the quantitative or mathematical reasons of things supposed identical in substance and activity; comparison being then quantitative in their explicit factors. Attributive differences are purely ideal or metaphysical; nevertheless, by an ellipsis of the mental subject the intuitive perceptions directly connected with the object are referred to matter and considered as its own qualities.

Quantitative differences, on the other hand—those of space and time—are always real, natural or physiological, though (by an ellipsis of the material object) the perceptions are directly connected among themselves, being compared quantitatively, and then referred to the mind itself; and because of this scholastics call them "relations of reason."

It is necessary, we repeat, to determine precisely the reflexive signification of the words which represent ultimate mental abstractions, with the view of making the ideas of language clear, in order to avoid the error of ontological realizations, which is the irreflexive or spontaneous tendency of the mind when we mention any term whatever, although it represents an idea that cannot be realized; and for this reason we shall treat of every one of them separately, in different sections.

§ 12. CONCEPT OF SUBSTANCE EXPLAINED.

This word in Ontology commonly represents an abstraction different from that which it represents when its signification is circumscribed to Physiology, because in the latter the supernatural or supersensual conceptions are set aside, as it considers only those things which produce extrinsic sensations—objects. In the metaphysical sense substance includes the spiritual and the divine or infinite essence—God and mental subject, while in Physiology it is generally though erroneously defined "as a passive existence which is supposed to be the basis of all the properties and qualities which things manifest." Such an abstract notion conduces to the illusory belief that something exists as "substratum" different from activity, and that activity rests on the substratum as if they were separable things. But we cannot represent in our mind any objective thing without manifested activity, and in nature we cannot recognize substance without activity. If substance is what remains apart from the manifestions inherent in activity, nothing can be known as absolute substance, passive matter, or motionless mass. There is no possibility of perception without the recognition of activity in that which produces sensation, and for this reason the existence of anything, after separating from an object all the manifestations, properties, or activities which connect the outside world with the mind, is a fantastic supposition of irreflexive imagination; thus material substance completely passive is no more than an elliptical term employed in the mental process of language in order to express an ideal notion and not a thing. What, then, is substance as a reality? It is nothing in cosmic reality; it is simply an abstraction. If physical knowledge must be based in intelligible conceptions, and if in nature nothing exists (at least for our reason) which could be absolutely a passive substance, because this could not impress our mind, the abstract notion of substance cannot be intelligible, and, consequently, a true or rational knowledge about it is not possible.

Substance, then, is only a connotative word, or a term of elliptical discourse, but apparently there is a reason in favour of the real existence of passive substance. We shall see that this is entirely false. It is said by many that, as extension is not only confined to material substance but must also comprehend empty space, the existence of some passive substance is also presupposed when it is recognized that something exists in that which is occupied. But in making such an illogical reflection they have not taken into consideration that in order to recognize what is occupied we have necessarily perceived something active in order that matter should manifest itself, and consequently we cannot make real reference to any passive substance, nor to absolute void.

It has also been a matter of objection that as the idea of repose is contrary to that of motion, by merely supposing matter without movement we can have a concept of passive substance. To combat such an idea we need only repeat the former argument, as no idea of absolute repose is possible in any place from which our mind receives the slightest impression. It may happen that as far as our senses can reach we do not perceive the movement of some manifestation or phenomenon and then we say in irreflexive language that there is repose. But reason tells us that the repose is only molar or in sensual appearance, and that there must be movement; as without this there is no sensation possible, because the reality of material things, as far as they can be known, consists in some change or activity propagated to our mind, and this presupposes, not repose but movement whether visible or invisible; no natural existence can be known if it is not under the jurisdiction of the senses, these furnishing the first ideas for the activity of the mind in our experiences from the world. Notwithstanding this truth, the notion of something completely identical in all matter has been erroneously affirmed as realized; and this illusory concept of abstract substance, which is a fantastic invention of the philosophers and which was only a hypothetical possibility in the thought of the Greek sages, many scientists of to-day have elevated to the rank of a fundamental theory of natural sciences (Physics, Chemistry, etc.) with their materialistic idea of the primordial or elemental atom. But the atom, even if it were the common element of all the material system, must, in order to manifest itself, be necessarily active and not passive; hence, if the atom represents any reality, this cannot be an abstract substance only, but the corporeal element of active matter. Besides, atoms are inconceivable as unities perfectly homogeneous in and among themselves, that is to say, the world cannot be identical in every one of its parts and in its totality, as we observe many forms of activity entirely different which produce in the mind the ideas of various attributes or properties in the same thing. Some authors think they can obviate this difficulty by imagining secondary atoms quantitatively different among themselves and also from the primordial; this they think sufficient to determine the differences among phenomena, as phenomenal differences are only quantitative, that is, in their relations of space and time. In any way either primordial or secondary atoms as well as any part of matter or the whole world must always be considered active, and no possible conception of matter can be made as passive or abstract substances.

Accordingly the signification of the word substance as a passive means and universal base equal in all things is beyond the reach of our comprehension; then it is only an imaginary being of nominal existence which cannot be explained and to which we can only refer in tautological language by words admitted as its synonyms, expressing a connotative concept or an implicit ultimate notion of the process of *mental abstraction.* Natural substance as a reality can only be comprehended as matter in movement, the terms substance and activity being complementary, as, we repeat, the condition of being active is essential to all that is manifested to the senses. Nevertheless, the word substance may be used elliptically in language (either internal, reflexive—or external, communicative) in order to represent matter in general when we cannot, and when we do not want to denote anything regarding its activity and quantitative relations. Then, not as a reality, but as a universal abstract noun, it represents an imaginary existence in which nothing active can be expressly determined; it is admitted as a convenience, and, it may be said, even as a necessity in the process of mental reflection, and also in that of language. We acquire our ideas only by mental abstraction, and we enunciate them separately, from which may arise the false appearance that every abstraction is a reality. This is the mistake of realistic philosophy, and the same error is implied in language when we enunciate separately, as different things, the universal predicate of being, and the special attribute of the predicate, in this manner making an incomprehensible distinction between grammatical subject without properties, or, *nothing*, and the same subject with properties.

§ 13. CONCEPT OF ACTIVITY EXPLAINED.

Abstract activity means power without substance, that is to say, a property or quality without any one possessing it; this is as great an impossibility as to suppose dancing without dancers, or war without fighters. Substance and activity are complementary, both together forming the notion of attributive existence. Yet with the attributes alone (substance and activity) our understanding cannot acquire the notion of material unity, that is to say, of something equal in its parts and in the whole, like the concept of atom, because such unity as must be supposed in movement is necessarily an object, and we need also to establish its relations of *space* and *time*, in order to complete the concept of natural existence, or of the material element which, therefore, is a relative and not an absolute existence. The nominal abstraction we make in the process of language when we reflect or transmit our ideas, induces us to believe, or better, to imagine that what produces our impressions is something really separated from matter, or that can exist without any substance—abstract activity; but an attribute is never manifested, nor can something which is the base of activity be even conceived separately or apart from an object.

Material, natural, or physiological activity consists only in propagated motion, in which there is nothing but a mutual ratio of energy; *i.e.* proportional energy or quantivalence in the interchanges.

If physical activity—movement—comprehends the notion of all that is acquired by extrinsic observation or experience, it is not opposed to substance; it is all that is attributed to the notion of objective reality, and to conceive it separately would be the same as to form an abstract conception of movement. But as everything, in order to be known and considered as a reality within the limits of natural phenomena, must determine some impression in our mind, all objects must necessarily be active or in movement. Hence, passive existence, we repeat, is in fact equal to nothing; it is only an error of imagination still maintained in science, or an elliptical expression to represent a relative state of repose in massive relations when only one of the forms of activity is mentioned—this is visible or massive movement.

We must not confound the words *inertia* and *passivity*, the first meaning phenomenal indifference, and the second the state of matter in apparent repose to the eye or in accordance with the immediate impression of the senses, expressing, in fact, that we do not see the motion of an object, at least, in relation to the things around it; in such a so-called state of repose there is necessarily some activity, as we shall see when we treat of invisible motion. Even the so-called passive resistance is produced by matter in movement, as some activity is necessary in any manifestation, even though it should seem passive to our senses. The sole idea suitable to the mind and differing from nothing is active existence, and in this the limit or ultimate point of scientific knowledge is the impressions acquired from the world, from which our reason forms the ultimate mechanical notion; this is, that all material activity is movement. Beyond this all terms are above our intelligence, as we can only define nature by what is manifested by means of the senses, and in order that a scientific assertion should be true it is necessary that that which has been experienced must pass under the control of reason as the supreme rank of the mental capacities—the office of judgments, inferences, and calculations.

When we discover in nature that all its activity is reduced to effected movements, and that following its successive propagations we arrive at a mysterious origin of organic generation, we can do no less than admit the influence of an immaterial generator, though any character of a Supreme Being is absolutely imperceptible to us. The phenomenal activity of nature is engendered by the sole power capable of doing so—by the efficient or determining *Primordial Cause*, *i.e.* by the Supernatural Power, the Almighty. The synthesis of the material changes effected in living bodies is called vitality, whose first phenomena result from the collocation or formation of organic material. Mechanical activity as the common abstraction of all forms of objective energy—that is to say, as the manifested power of the world, is primordially effected by the special function of living bodies in the generating power of organism, which act is beyond the reach of our understanding. We can only imagine it as a spiritual connection between the Creator and living things, relegating the questions of this problem to Theology, a branch of Supernatural Philosophy or Metaphysics. For us, then, activity denotes only what is definitely produced by propagation of movement; this is the natural or physical effect whether manifested or not—and comprehends the phenomenal and potential changes of the world. This activity (material energy) can only be propagated, it can never be created or annihilated; when there is an appearance of cessation, there is only a change in which things have passed to an imperceptible form of action—potential state, and when the reverse occurs, *i.e.* when there is an apparent creation, it is that a form of imperceptible action has become perceptible—phenomenal state. In this manner nature is incessantly changing.

The universe is a perfect system in which nothing is independent, and when there appears to be independence among the changes, it is because some intermediary action was imperceptible on account of the mediation of an invisible object between two visible ones by means of which these, though separate, propagate their actions. A continuous connection in matter must always exist for any propagation, and we repeat again, when an action appears to take place at some distance, there is certainly an indirect propagation or transmission by means of some moving thing which has escaped our sensual observation; then reason recognizes the necessity of some interactions by contact or contiguity. Attraction is a myth, and not a possible form of activity; in all cases where attraction appears to be, we must look for the series of interactions which necessarily exist between bodies that seem to influence each other at a distance.

Always bear in mind that the cause of vitality must be excluded from the concept of physical activity, as that generating power produces an interaction which is originated and not propagated. Such transcendental action on the organism is as different from natural phenomena as creation itself, and thus living interaction may be considered possible as generated by the Almighty alone. The generating action cannot be propagated to organism from the material world, in which nothing is created or annihilated; all in nature is continually changing by vitality, which causes matter to pass in its mechanical, propagating activity from the inorganic world to the organic, and the reverse, rendering manifest in this manner the energy which is continually converted into latent by a series of acts purely mechanical, as is seen in the continuous loss of living force in machinery.

The connection between cause and effect in Physiology is an abstraction of activity itself when we comprehend only the antecedents and consequents of a change, or of a partial system of changes. Physical cause being always a propagation of movement generated in the process of vitality, primordial cause is never found in experimental facts; those which are recognized as causes of some phenomena are only the effects of other changes of former activity; and in this endless chain of events the primordial effects in cosmos are, we repeat, the acts of organism, so that vitality being a synthesis of all the effects of cosmic mechanism, permits us to conceive the world, suppressing in it all the physical forces which are supposed to be abstract causes, and which are called attractive and repulsive forces by scientific writers.

§ 14. CONCEPT OF SPACE EXPLAINED.

True scientific distinction between one object and another does not depend on attributive differences or qualitative abstractions, but on their various relations or quantitative abstractions. We have already said that there are two elemental relations—space and time. It is necessary to acquire a concept of them by reason from experimental data as their ultimate notions cannot be comprehended by words alone, nor by intuition.

We acquire the idea of *space* from its two forms of relation—*extension* and *distance*. Consciousness refers its impressions sometimes to the mind and sometimes to the world. Extrinsic impressions are referred to any object which we recognize and admit, apart from the mind, so determining the idea of the relation of space by the appreciated distance between such an object and our mind. When such an inexplicable perception is many times multiplied it is clearer to our understanding, because taking some determined space as an average we establish the measure of space or its *extension.* Besides, when we perceive two objects at a distance from each other, that is to say, separated by an interval which is not made manifest to us by visible signs of continuous objects, we call such an interval also space; and, finally, when we compare all the impressions of position of the different parts of an object we identify more and more clearly the idea of space with that of the extension occupied by such an object.

In mature age we immediately refer the experiences of the senses to things in space and time, and this is what makes it so difficult to assign to the different senses their participation in the process of establishing the mutual relation of exterior things. So that the perception of things and that of the relations of space are formed at the same time. Objects do not begin to exist for our mind until they are individualized in space; while, on the other hand, as soon as they are distinguished in the relations of space, these relations appear to be as objects. For the perception of extension all the senses must have some power, but not all the sensations are equally efficient in presenting to the mind the representation of objects in space. Taste, hearing, and smell can scarcely localize objects; sight and touch (including articular and muscular pression) determine their locality much better. Nevertheless, in actual experience our senses work in co-operation, and the mind uniformly interprets the sensations, there being a fixed relation between the given form of sensation and its interpretation in reference to space, because the sensations cannot be interpreted in each one and in the different forms of such relations. The exact connection between an object and the perception to which it gives rise is a fact which cannot be demonstrated.

The most important external perception is that of space, with its two forms—*extension* and *distance.* We cannot consider extension as a reality without losing our intelligence in the labyrinth of the infinite divisibility of matter, so making a contradiction of the conception of *being.* It is referred to an aggregation expressing only a certain order of relation among the aggregated elements. The concept of space, then, is not necessary as a mental principle in order that we should form its true knowledge, because no other idea of space can result than that of conceptual relations. Our judgment of size and distance also is acquired by experience, for the mind must learn by external observation how to perceive the sensations which teach us those relations, as such perceptions do not result from immediate contact with the object but by means of some nervous changes produced by the object. The action of the nerves, then, is the inciting cause of sensation, and this in turn becomes the inciting cause of perception.

Absolute space—that is to say, space as an existing reality in nature independent of matter in movement—is a senseless phrase which implies the indeterminable sum of all extension of occupied as well as of empty space, including in this the infinite space which is beyond the reach of our senses and of our understanding. The infinite cannot be a material thing; it is a word without real representation; it is the negation of the finite, and is consequently the existence of nothing in nature. There is no comprehensive notion of absolute space if this embraces not only what is occupied by the known world but also by the unknown. The infinite—space in absolute—considered as a thing existing before the creation, is a metaphysical problem. In such a sense space cannot be an object of physiological reference, its discussion is inseparable from the concept of the supersensual, and so does not come within the province of Physiology; nevertheless, space is still considered by most ontologists as an infinite reality. Reason infers the idea of natural space from experimental data, and not simply by intuition, as space of course implies movement either visible or invisible.

On the other hand, the hypothesis which maintains the absolute limitation of the world and of space, is contrary to the most fundamental truths; it is an error equal to the supposition that the atom is the absolute minimum of corporeal extension. In order to arrive at such an erroneous conclusion the pangeometers—maintainers of such a hypothesis—start from an abstruse basis, such as supposing the discovery of new dimensions in space, affirming that the true and real space has four or more dimensions, and not three as is generally taught; that the ordinary space of three dimensions is only one of its possible forms, adding that in real or absolute space every line previously considered by common sense as straight could be converted into a closed curve if sufficiently prolonged, because, they say, space has some curvature which is inherent in itself, thus being limited in a spheric, or pseudo-spheric form. They pretend that such assertions can be experimentally proved, presuming besides that numerous optical, magnetic and other phenomena can be thus accounted for; and they also claim that such a notion of space is the base for the discovery of the mysteries of modern spiritism, considering this as produced by natural causes, because otherwise, they say, such phenomena would be elevated to a supernatural rank! The members of this geometrical school, which they call transcendental, have confounded the facts which they wish to explain with false ontological abstractions, starting from the erroneous concept that space is a real thing; not only an object known to experience, but an independent object of direct sensation, which, according to them, can be recognized by means of instruments of physical and astronomical investigation, so empirically establishing the properties of space as one may those of any object or physical thing.

This conception of modern metageometers about spheroidal finite space is not new. It has been enunciated in Aristotle's "Cosmology," with the advantage in favour of the wise Greek that he did not infer the extravagant conclusions of our contemporaneous mathematical philosophers. No further commentaries are necessary to see that such a conception is contradictory to fact.

We must not confound the untenable idea of space upheld by the sensualists, with the evident proposition that all knowledge of the objective world is derived from experienced data. Space is a product of mental abstraction ; it is a concept ; like extension, it is simply a relative character corresponding to all the objects of our sensual experience, and is reduced to nothing when all the sensations are ignored. Space is neither a physical object nor an innate form of the mind independent of and forerunning the sensations. Space has neither proper form nor evident structure, but is simply the conceptual possibility of all forms of geometrical construction which depend on the concept formed by the abstraction of all the properties and figures which distinguish objects. The first elements to form the concept of space are the perceptions which we derive from the limited extension of bodies ; from these arises the indefinite abstraction of space. When we state that all forms are in space, that extension is a necessary condition of all things having objective existence, we mean to say that there is nothing in physical reality which can be without extension. No act of sensation can disassociate the extension of a body from its other properties and manifest only extension. Thus this, which is an irreducible or ultimate act of sensation, when, for instance, it is acquired by the eye, is necessarily associated with the sensation of colour, which is a form of activity and an ultimate or irreducible quality. Confounding the concept of space with sensation, there could be no possible distinction between space and matter; if such were the case, all objective existence could be called indifferently either space or matter, because these two terms would then have the same signification.

Enough has been said here to judge not only the sensualists (materialists), but their adversaries the spiritualists, because both take the same error as a base; both consider space as some existing reality, either as an object of sensation (sensualists), or as a form of intuition (spiritualists). In either case the result is the same, because these doctrinaires conceive space independent of objects. But, as we have already said, the mind alone cannot imagine, nor obtain the sensation of pure space; on the contrary, the idea of space is always relative, for it is associated in our consciousness with something determined by sensation. In opposition to this true view, *idealism* has wrongly interpreted the concept of space in two ways, one school having for its leader Kant, and the other being led by Fichte and Schopenhauer. According to Kant, space is a form of pure subjective intuition (intrinsic intuition) existing in the mind with independence and anterior to all acts of sensation. According to Fichte, space is also purely subjective; he adds that space, being entirely in the mind, cannot be the basis for anything outside the mind itself, and he concludes that the mind is the only ground where objects can exist!

All these erroneous conclusions, we repeat again, depend on the false ontological supposition that every concrete thing and every abstract entity is considered as really existing with independence; and in order to avoid falling into the error of such an absurd hypothesis, we must always bear in mind that in all initial acts of the understanding what is called phenomena or objective manifestations, and qualities or subjective distinctions, result, both at the same time, from the mutual action (interaction) between object and mind, the names of objects being nothing else than terms of attributive and relative abstractions.

§ 15. CONCEPT OF TIME EXPLAINED.

What has been said about *space* is applicable to *time* by simply making a substitution of terms. Thus the word *duration* as a measure of *time* is the correlative of *extension* as the measure of *space*.

In order to be enabled to recognize an objective impression, a change must occur in sensation, and no change can be conceived without succession; an undefinable relation is then admitted by the mind which establishes a difference of time between an impression previously recognized and what occurs afterwards.

Time in absolute is only a nominal phrase, without a real signification; it is in the same case as the imaginary subjects already treated of—Absolute Substance, Absolute Activity, and Absolute Space or the Infinite. Common time is the standard of comparison used to determine the duration of change with more or less exactitude. Time, supposed to be continuous, is measured by the return of objects in space to certain relative positions, but such a return depends on physical conditions which are variable, and consequently the results are variable also. This happens with our modern chronometers, although not to such an extent as it did with the hour-glass of the ancients. No instrument is absolutely free from friction, or from variation in intensity of gravity according to the latitude, or from changes of extension which are effected by variations of temperature; even the celestial clocks, like the sun and stars, suffer changes that make absolute equality indeterminable in the measures of time, as there are indeed secular irregularities like some disturbances of celestial gravitation. Consequently absolute constancy of succession in time is simply a conception of the mind as illusory as the positions in space which serve as fixed points for determining the quantity of movement. The concept of the abstract idea, *time*, is of little importance in physiological science, and a criticism similar to that made of space is applicable to it; so that we have sufficient with what has been said.

§ 16. REAL OR CONCRETE CONCEPT OF MOVEMENT.

All that can be perceived by our senses, which is the object of physiological science in general (Physiology, properly so-called) is necessarily active substance—moving matter—in which relations of Space and Time are defined, and consequently the terms Substance, Activity, Space, and Time are abstractions of language from moving objects or concrete motion; when we mention one of these terms we make the ellipsis of the others, which are then unnecessary or unknown in a determined manner. When we have tried to define every one of them as a particular existence we have had no possibility of doing so except by verbal propositions, that is, by means of terms analogous to themselves.

The supreme or ultimate proposition of Physical Science must be the recognition of universal organism, admitting that the primordial movement of phenomenal changes is effected by the act of vital generation, whose agent is potential and not phenomenal, and that those changes observed as directly producing the experimental or ordinary idea of movement are always secondary; and as a corollary of this proposition we affirm that mechanism—object of Universal Physiology—is the concept of motion formed by abstraction, but comprehending in it the derived changes of the *system.* Thus all which is physical, objective or material, is only matter in movement. And what is movement? It is an ultimate or inexplicable fact which can only be defined by words synonymous with itself. The word movement has two significations; in the abstract sense, as a concept separate from matter, nothing exists which is really movement, this being only the possible reason of all physical activity; and in the concrete sense movement is an elliptical term of language in which the existence of matter is implicit. In this last sense it has been the subject of analysis in this chapter, because movement is the complex concept of the four ultimate abstractions of all natural being or object, that is to say, of the four conceptual elements which result from the mental analysis of all objective things: Substance, Activity, Space, and Time; circumscribing the signification of these terms to the concepts of natural beings or those which are manifested to the senses. These four words are the ultimate terms of scientific language, and are not only undefinable, but also inconceivable as realities.

In language they represent the grammatical subjec and universal predicates of objects. Hence, all physica changes in general, and each one in particular, being kinematic, that is, resulting from movement, necessarily presuppose Substance, Activity, Space, and Time; i these four conceptions are not expressed they must be tacitly recognized, and in this sense it can be said that all real existing objects suppose the mental synthesis of the four universal abstractions—two attributive, Substance and Activity, and two relative, Space and Time; and such a synthetic notion is ***movement*** in reality.

CHAPTER II.

GENERAL CONCEPT OF MATTER (*continued*): (B) RELATIVE SIGNIFICATION OF THE FOLLOWING PHRASES:—

§ 17. Properties of matter—§ 18. Essence of matter—§ 19. Matter and force—§ 20. Mass and movement—§ 21. Universal attraction—§ 22. Physiological or physical change—§ 23. Inertia of matter—§ 24. Conservation of energy.

§ 17. PROPERTIES OF MATTER.

The concept of matter, as we have just seen, is very complex, containing in its signification the four conceptual elements: the two attributive, substance and activity; and the two relative, space and time.

Ordinarily speaking, *matter* expressly means only the substance of objects; this is the irreflexive signification of the word matter; but in the scientific sense this word connotes the notion of the other three elemental abstractions which are the complements of substance: activity, space, and time. These words, physiologically employed, express, as we have already said, abstract concepts, limited to the objects or material things, which are concrete realities.

All the so-called properties of matter are, like the conceptual elements, but abstract concepts, nevertheless extension and impenetrability are considered as universal properties of matter by all physicists, excepting those who maintain pure dynamism by denying the real extension of matter and admitting only elemental activities without extension, related in the infinite in such a manner as to produce sensations with the appearance of a world of corpuscular things not continuous in space. With such a fantastic idea some physicists, among them great mathematicians, presume to solve the difficulties of some problems of matter such as its unity, divisibility, and indestructibility. This hypothesis of pure *dynamism* explains penetrability of bodies by the false statement that matter is absolutely lacking in extension, and that it is constituted by mathematical points endowed with the ideal elements they call forces, which are considered to be infinitely small (and this amounts to nothing) in comparison with the distances which separate them from one another. Dynamists, then, consider the total extension of objects as an effort of the predominating repulsive forces of such points. It is clear that this inconceivable hypothesis springs from a mathematical abstraction.

We must recognize extension as a general predicate of matter which is employed in all objects, but it does not establish absolute distinction or attribution, it is only a distinction of relation. It has already been effectually demonstrated that extension is the measure of the relations of space, that is, a quantitative determination of any object or group of objects. Two objects could not occupy the same space at the same time if they were extended in absolute, and this is the meaning of the word impenetrability. But practically we see that all bodies are penetrable, a fact which is contradictory to the idea of considering objects endowed with absolute extension. This contradiction is obviated by giving to the terms "extension" and "impenetrability" their true relative signification, as practically we never reach the limits of the minimum extension of bodies, nor of course the limits of their impenetrability; a complete or absolute case of impenetrability never comes under our observation.

But most physicists pretend to know by direct sensual experience that bodies are impenetrable, and they say they arrive at this conclusion without even the necessity of appealing to reason. They have formed such an illusion from the crudest appearances of massive mechanics, considering space as an objective entity in which every object should occupy in its minimum extension a fixed or determined part into which no other body could penetrate, for that space they say is absolutely full. But the determination of minimum or absolute extension is an impossibility, it is an eternal "X" (unknown quantity) practically indeterminable, and parallel with the fixation of the absolute zero in the thermometric scale, which can be only the reduction to nothing.

We have already demonstrated that the reality of space is an ontological enigma, so it only remains for us now to prove that experience has never given us the knowledge of the minimum limit of the extension of a body. No one doubts that when we submit bodies, especially liquids, to compression by means of the most powerful machinery, we find a limit of compressibility to the strongest forces that can thus be employed in molar or massive mechanics, but we must not infer from this that we have reached the minimum extension of bodies or the limit of their impenetrability, because the same space can be occupied by another body, as is observed from the reduction of volume when many fluids are mixed, and from the great contraction of volume which frequently occurs in the combination of liquids, though they seem incompressible by the force of the most powerful presses. It is also well known that if two or more gases are enclosed in the same cavity (even without determining chemical metamorphoses) each gas is distributed in that space in the same manner as if it were alone.

All bodies are really penetrable, and the continuity of their contents is only apparent. Impenetrability as well as extension is a relative property—a relation of space—which depends on the mutual action of bodies, and not an absolute inherence in matter. It is evident that a determined particle of matter must occupy some minimum space, but this fact cannot be acquired by our knowledge of objective realities, as these are constituted by corpuscles separated by imponderable ether always in movement (heat), and consequently the space which is apparently occupied by bodies cannot be absolutely filled with matter, because otherwise such movement could not be possible.

The false presupposition that objects are in reality in the same correlation as they appear to human understanding has also conduced to the error of considering impenetrability of matter as an absolute property known by experience; thus, because solids are perceived before fluids, we are inclined to the spontaneous or irreflexive preference of supposing that matter is primordially endowed with solidity, or impenetrable rigidity, and that softness, flexibility and fluidity result from complex modes of aggregation. But, as we have already said, the ultimate corpuscular elements of bodies—atoms, which are supposed to constitute ponderable matter—must never be in perfect continuity or absolute contact in all parts, because otherwise they would not permit any form of internal movement, which consists in oscillations of imponderable matter (progene), the degree of temperature and the state of bodies being thus determined. The affirmation of impenetrability is merely gratuitous in the sense of observation, it is solely a condition which presupposes reasoning, because to deny it would be a contradiction of the affirmation of objective existence. But what are in reality the practical limits of penetrability? We do not know them, we repeat, any more than we know the absolute zero or absolute lack of heat. Accordingly *extension* and *penetrability* (instead of impenetrability) are sensual data of quantitative relation which vary, not only in the quantity of matter, but also in the movement of the mechanic action, internal, as well as external. The different states of bodies result from the relation of internal and external actions, which arise from the interaction of objects with one another. Solidity is not an attribute of objects; it is only the concept of relative abstraction; in reality we have never seen an absolutely solid body; the greatest or least resistance observed in different bodies is a relative condition especially contrary to thermic activity. All material elements have not the relative properties of ponderable masses, though these properties are determined by the effect of the distribution and interaction of the parts; the relation among the material elements is purely dynamic.

We shall see that the solidity of a body does not depend on the integral solidity of its ultimate elements, but results from want of equilibrium in favour of external pressure upon the constituted elements of a solid body; so that the resistance of a body to yield in its extension, or to break, depends, not on the absolute continuity among its elements, but on the control of heat expansion by external pressure, principally that of imponderable ether (progene) which compresses all bodies. The idea of absolute solidity of matter, from which the idea of absolute impenetrability arises, is an unreasoned perception, a superficial and imperfect datum of the most culminant sensations acquired during our childhood, and from our most ordinary experiences. Solidity is the most complicated structure of inorganic matter; in truth, organized matter is the more complex, but this is because it comprehends in the same body all the different states forming a whole. We must affirm, in conclusion, then, that there are no absolute properties of matter, that even extension and impenetrability are relative.

§ 18. ESSENCE OF MATTER.

There are, in reality, no essential differences among objects. On what, then, depends those so-called essential differences of matter? What is that which is called essence or proper nature of every object?

A doubt instantly arises in our mind as to the possibility of knowing the true or qualitative essence of a thing, because we lack the assistance of the proof of the senses which gives no more experimental data than those which oblige us to recognize attributive or qualitative identity instead of differences of substance and activity among material or objective things.

The essence of matter cannot be found by what are called its qualities, as these do not reveal how matter is, but only how it affects our mind; thus the same object can produce opposite sensations by producing contrary ideas of quality, and if the qualities of that object, whose essence we would like to express, change or vary, the result would be the contradiction that the same thing is not the same. If, on the other hand, the word essence were employed to signify something persistent in the object through all observed changes, it would represent a supersensual problem whose resolution would be in the dominion of pure reason or Metaphysics.

Accordingly, if the terms "essence" or "qualitative nature" were admitted in Physiology to express what is characteristic in every object, they would not express any quality, but only commensurable quantities or material relations of space and time, which vary with the active change that occurs in all things. Hence the qualitative nature or physical essence of things may be spoken of only as a pure mental formula, expressing the most persistent mutual action of objects in their quantitative variations, which, of course, are not absolute but relative. Furthermore, the determination of the proper essence of objects should not consist in fixing definite velocities and directions of movements at a given time, but in fixing the general velocity and constant direction of objects at all times, which is an impossibility on account of the condition of variability in the universe.

Physicists commonly speak also of the essence of substance as something different from the phenomenal and potential activity of nature. But it is a fallacy of language to say that phenomena have their proper essence in absolute when only the differential characters which result from the changes or modes of movement are observable, and these are always quantitative differences, and therefore differences of space and time.

Neither is an essential or absolute distinction in matter possible between the potential and the actual, or, in other words, between the latent and the phenomenal, because the actual differs from the potential only in the quantitative conditions of the propagation of movement; in the first place its influence can be felt in sensation, while in the second there is not sufficient intensity in the propagation to produce a mental impression through the senses. For example, if a movement of four vibrations in a second should be propagated to our ears, it is not sufficient to produce sonorous vibrations, nor will any vibratory movement be felt if it exceeds forty thousand vibrations in a second. In such cases there is an energy which is not manifested to our senses because of defect or of excess of celerity, and which is called potential energy. This nevertheless may be usefully employed by converting it into phenomenal movement. Therefore the distinction which we try to establish between the words potential or latent, and actual or phenomenal, is purely personal or subjective. That which is called potential, virtual, disposable, or latent, is what is not manifested to our senses because the factors of movement are not in the relation necessary to impress the organs of sense, and propagate it to the brain in order to determine the sensations. The potential state of matter is as well defined by reason as can be the forms which are seen and touched; the difference of phenomenal states are determined only by sensual effects, and consequently they are defined only in their appearance, not in their evidence, which last can be recognized and judged by the supreme faculty of reason alone. In action all that is directly appreciable by the senses is what is qualified as actual or phenomenal, but in the exact sense all that exists is actual; nothing can be a potential thing in absolute, and consequently such expressions are in reality figures of speech always implying a dynamic state of the objects and not any essential difference. Nevertheless, we admit the term potential, in a conventional relative sense, to signify that which is not directly manifested by the senses, and which we recognize by reason alone, when, with the appearance of spontaneity, phenomenal determinations are produced by energies not directly perceptible; then the occult proximate causes are called potential.

If within the limits of our intellectual efforts the essence or proper nature of an object is known only by the quantitative relations of its activity or movement, we must investigate what is the essence of matter by observing how the objects of cosmos act. Our intelligence cannot go beyond the calculations on extrinsic perceptions, acquiring from these alone all the data for the knowledge of matter. We must not forget that our understanding is limited, and that man, being a creature, cannot control a supernatural intellectual domain. In other words, if the essence of the proper nature of objects makes reference to human capacity it must not be in matter itself, as this cannot have an essence as different entity; matter is the whole (in objective cosmos), and its essence is in the ratio of its definite modes of quantity, and from the form and continuation of activity we derive the law of its action. By this we do not mean to say that a law governs cosmos, but that cosmos acts in accordance with a law which is but a quantitative relation. All cosmic law, then, is also relative and not essential; the essential or primordial law by which an object has been created and is governed in its activity, is and will be for ever as enigmatic for the most piercing intellect as for the savage. Thus, we do not tire of repeating what we have said many times before, that in the things defined in nature (for human understanding at least) as the sole physical realities, the distinction between object and its law, like that between substance and activity, matter and force, or mass and movement, is nothing but a division in our mental speculation. Hence, we affirm that the essence or qualitative nature of things is only an abstraction or mental separation of that, which, being more constant among the activities of a thing, characterizes or distinguishes it from the others so as to aid us in our scientific purposes, but it is a relative distinction, arbitrary or conventional, though useful.

§ 19. MATTER AND FORCE.

All objects must be considered as a field of finite though indeterminable extension always in activity, which may or may not be manifested; otherwise we could say that matter does not exist as well as that it does exist, and material nature would be reduced to a pure ideal thing, which, sensually or objectively considered, is equal to nothing.

Matter cannot be the passive object of force, as is said by atomists and materialists, for a thing without activity cannot be an object for the mind; thus physicists usually say that matter is a vehicle of force, but a thing cannot be a vehicle without power or energy. Strictly speaking there is no absolute repose, no absolute inaction in nature; an object, in order to be perceived, must exist with some corresponding action to impress the senses, either propagated directly or by means of something which propagates the activity between the object and the senses.

Hence the distinction in nature between matter and force is only verbal, it is merely a difference of words to express the same real thing in a definite sense. The terms "matter" and "force" do not represent separate existences in the reality of cosmos; to carry into the world of objective things such a distinction is to labour under a delusion of language. In reality, when we speak of an object, we adopt the same form as in the judgment, putting the name of the thing as the grammatical subject separate or apart from its attributes or relations which are the predicate; in this manner language makes a fictitious division between the thing itself and its predicate, but an objective substance does not exist separate from its predicate, although such a distinction is made in thought and language; thus we speak, though improperly, of matter as containing forces, and so imagine that there are true entities separate from matter; in this manner even the sagest minds have fallen into the erroneous idea of admitting and recognizing in nature many abstract forces, as attraction, affinity, caloric, luminous agent, etc., so representing matter with several forces, some of them fatal (inevitable in their effects), and others elective (choosing their effects). Thus, for instance, attraction is considered by astronomers as fatal according to the law of distances, while chemists consider affinity, and biologists irrita-

479433

bility, as elective. Besides, they say that every force is independent. This cannot be so; the notion of force is in every case an abstraction. Forces are separate only in the mind; they are mental abstractions by which we determine the different classes of acts which are discovered in nature: *forces are simply the measure of movement.*

Every act of matter must be directly attributed as a proximate effect to matter itself, and not to illusory abstract forces residing in object; any other conception is contradictory to fact. Passive matter is never discovered by rational experience, for we know an object exists only because it acts through our senses. Reflection conducts us beyond the apparent repose of matter, and then, with the light of reason, we see the real world which always manifests power in incessant action. Therefore, when a thing that was in mutual action with others appears after a change operated in its relations, as passive matter or matter in repose, this will be only a relative state which must never be confounded with absolute repose or passivity. If we affirm the indestructibility of matter, it is because it never becomes inactive in absolute, otherwise for us it would be annihilated. Nevertheless, the ancients, almost without exception, believed that the natural state of things was repose, that objects could come into motion only as the effect of some exterior agent, and always resume their tendency to repose as soon as the action of the agent was removed; movement being considered by them a violent and accidental state of objects. This would be true if there were no other movement than the phenomenal or manifested, and, consequently, the cause of such an erroneous belief is sensual or irreflexive experience which constantly furnishes us with apparent proofs of the difficulty which exists in initiating a movement in ponderable matter and also with the apparent tendency to the cessation of molar movement.

When we reduce movement to the field of sensual irreflexion, without thinking of that which must also exist in the actions in which there is no visible change in the place of things, the word movement then signifies only molar movement like that of massive mechanics. The irreflexive concept of matter and force as different things is taken also when we make an effort to move ourselves and after some time are obliged to rest; then, extending the meaning of the word movement, this personal condition is translated to all things, and finally, the dissipation of physical energy observed in all mechanical changes inclines us to the idea of the tendency of matter to repose.

At present many physicists maintain an idea opposite to that of the ancients but equally incorrect, affirming that movement is the natural state or inherent condition of things. The materialistic conception is obliged either to endow matter with movement in itself (automotion), without any dissipation of manifested energy, or to imagine the existence of material motors in nature (abstract forces), which would impel matter to depart from its natural tendency which according to such a supposition is a state of repose. The modern concept of constant or persistent movement, according to which motion is supposed to be an essential or inherent property of every objective element, is altogether materialistic. But if matter were so, every element abandoned to itself would move with a constant velocity as the result of its own nature; this is directly and completely contradicted by the unquestionable fact of inertia of matter.

Movement must be truly considered as the universal state of manifested objects; not as an attribute inherent in matter, but as a relative effect, because movement can only be admitted as an indifferent condition in which matter may or may not be, as is expressed by the principle of conservation and the law of inertia; so if we consider matter as having determined movement it will continue with the same movement, and if we consider it in repose it will remain in repose. But if movement does not proceed from matter, if it is only its physical mode of being, what is its cause? Who has put matter in movement? Here we arrive at a truly primordial fact of creation, and, therefore, the *actor* will be the *Author* of all things. In addition to this, movement in nature is not absolutely uniform; on the contrary, it is always changing as a proximate result of the mutual action of objective elements. And what is the primordial cause of such a change in movement? It is the engendering power of vitality which is also a final or ultimate act. Hence we have two classes or categories of causal connection in material activity: first, engendered forces, *i.e.* the primordial changes or movements of nature (potence of vitality); and second, derived forces, *i.e.* the secondary changes or movements in nature (acts of mechanism or materiality). By the former an energy is manifested greater than that which was spent, and by the latter manifested energy is constantly lost, being resolved into a latent or potential state, from which it moves to the actual or phenomenal state by the acts of vitality, so closing the circle of life in the universal system. In addition to this, vitality includes all the forms of materiality, that is, all kinds of mechanical acts, which are afterwards propagated to the inorganic world to repair the loss of living force.

All phenomenal variations or extrinsic manifestations imply a change of movement whose measure is the forces which may be propagated into another manifested movement, or transferred into a potential one. Now if the notion of one object is unity, how does it produce such plurality in the manifestations of its activity? Because manifested activity results from composition of forces, although, properly speaking, in an ultimate analysis it is but the various modes of the sole and persistent state of movement in which matter is always kept; and, consequently, objective unity is relative; the manifestations varying with the proportions in which the components come into action—intermotion.

§ 20. MASS AND MOVEMENT.

The same criticism which establishes the relativity of movement is what has served us to settle the relativity of activity, space, and time; thus it only remains for us now to apply what is said about the relativity of substance to that of mass also.

We have seen that the terms substance and activity are in reality synonymous and not complementary; each alone truly represents the whole attributive idea of any objective thing; they are neither separate nor joined, but only one thing alone. Some who object, as we do, to the asserted distinction of realizing such abstractions, try to explain mechanism by saying that material activity or force is nothing but movement, and that the only thing opposite to force or movement is *mass.* But they fall into the same error, because mass and movement, like matter and force, are not complementary, they are inseparable; in fact, there can be no mass without movement, and no movement without mass. What, then, do these words mean? Like substance and activity, they are nothing but symbols of concepts of mental abstractions taken from cosmic mechanism, physiological universe, or material nature. Thus, when we refer to *mass*, we mean the measure of the force of gravity exclusively, which is a resultant of movement; but because of this we must not forget that that which may be a manifested object cannot be passive matter; that when we speak of active movement it is only to differentiate it from relative repose, as objects are always in movement either actual or potential. It is evident that a pure movement, separate from all bodies, is an impossibility; and we must say the same of the other correlative terms, the true proposition being that in the real concept of any of the terms, matter, mass, force, or movement, the four conceptual elements are comprehended—that is to say, the four universal abstractions or simple categories of object: substance, activity, space, and time. Mass is the measure of some movement propagated from one object to another, and its intensity depends on the relation among the four abstractions here mentioned. What is said here of mass may be said also of the other three terms which are in reality correlative with mass. Matter, if it is ponderable, is measured by mass; mass is measured by the force of the gravitating resistance; and movement is measured either by mass and velocity or by velocity alone. Nevertheless, physicists speak of mass and movement not only as real elements of matter, but also as always existing each in the same quantity in cosmos; this affirmation also, thus enunciated, completely lacks foundation, because mass and movement, as well as any other relation, are susceptible of increase and diminution. Again, in ordinary Mechanics mass and inertia are considered as synonymous terms, and are measured by the force of acceleration or of deviation in the movement of a body—that is, by the force which is necessary to propagate movement to a given body in order to determine in it some velocity. This use of the words mass and inertia is of course limited to ponderable or atomic matter alone, with the abstraction of the differences of place or position of bodies.

Mass, movement, matter, and force are not only inseparable concepts in reality, but they are not even separable in thought. All are terms of relation among objects of sensible experience, without any difference among them than that which they have in abstract language on account of the omissions or ellipses which are necessary to scientific explanations. Such differences are therefore only verbal; they are only differences in words, and not in the real or true propositional sense. We need not refer back to the realism of the Middle Ages to see the conceptual elements of things confounded with objects of sensation; such an error has caused modern physicists to cheat themselves into interpreting nature by their mechanical atomic theories. This error has produced the most contradictory consequences, and has given rise to endless discussions without any foundation. Mass is not a real thing or individual entity which can be directly presented to the observation of the senses, or that can be known objectively by thought. It is nothing more than a definite determination by thought in the relations or mutual dependence of matter in movement; it is merely a result of calculation of movements whose measure is the dynamic correlation between the antecedents and consequents of a physical change. Nevertheless, mass, like physical force, is a term of quantitative relations necessary in our discourse and in our thoughts. The measure of the mass of a body is inverse to the acceleration produced by a given force, and the measure of force is determined by the acceleration produced in a given mass, of course referring to ponderable matter. The ordinary method to determine the mass of bodies by their weight is merely an arbitrary agreement among scientists; it is not based in the nature of anything. Moreover, the weight of a body does not depend on itself in absolute, but on its relation with others, differing according to the position of the body, and especially according to its distance from the centre of gravity of the earth, because the velocity of falling bodies near the surface of the earth is greater than if the experiment is made at a great elevation, as is proved by the oscillations of the pendulum.

§ 21. UNIVERSAL ATTRACTION (WHICH WOULD BE BETTER CALLED ATOMIC GRAVITATION).

If activity of nature cannot be absolutely independent and proper to matter but must relatively depend on what is a genuine cause, what is the true interpretation of the so-called universal attraction and of its law in relation to distances? Physicists say that matter attracts itself with an intensity which varies according to the inverse ratio of the square of the distance. In this manner they admit an abstract force or specific cause which is not merely matter but something united to it, so separating the cause of an act, which is the agent in itself and therefore a thing, from the field of action, which by a peculiarity of nature under appropriate conditions is converted into the apparent cause of the act. This is the same as to deny the fact that substance and activity are only abstractions of reality, and not two different things.

How, then, must we explain the appearance of facts according to the so-called law of universal attraction? Only by propagated impulse; thus, in gravity, for instance, as the surface of the spheres varies with the squares of their radii, an energy, in order to be centripetally propagated, must be distributed in four times less quantity of matter in another sphere of half the diameter, where, therefore, the energy will be four times more intense than in a surface of the same extension but corresponding to the greater sphere. The centripetal impulse, then, will increase according to the ratio of the square of the distance. Hence the fact of gravitation must be explained by pressure, that is to say, the force of gravity cannot be attraction but only the measure of an impulsive movement. We cannot study the generation of such an impulse until we treat of Synthetic Physiology (Part II. Chap. VII.).

To produce any material interaction we must suppose matter in immediate continuity or contact, as it cannot do anything else but propagate movement by impulse. In matter there can be no attraction, nor can there be any influence acting at a distance, because to admit this would be the same as to recognize that every particle of matter must be omnipresent and omnipotent. We must give a brief dissertation on this point to settle the most transcendental truth of the Physiological Theory here set forth in such a manner as to satisfy, not only the intuition of facts, but also our rational intelligence, in conformity with the laws of thought, and with the principle of conservation.

We cannot conceive matter as containing inherent forces, either of attraction or repulsion, but as determining different forms of manifestation by the mutual action of the parts, according as these vary in their circumstances; because force, as we have seen already, is nothing more than an abstraction of the forms of physiological activity. It is also absurd to define force as the unknown cause of phenomena, as is expressed by the phrase, "force of attraction," for this will lead to the belief that forces are things, as only things can be causes; and besides, as the only aim of our speculation is to find the proximate causes of phenomena, the final result will be that only forces could be recognized, which is the erroneous conclusion of pure dynamism. If force in general and attraction in particular were real things, we ought to know where they come from and how they can be engendered so as to fill space. If attraction is supposed as an influence alone, then we have only a figure of speech without real signification; and if, according to most physicists, attraction is supposed as a cause inherent to matter and therefore as something really different from material things, this would lead to an incomprehensible dualism in which the forces will be as things different from the manifested being, and nevertheless will not be anything separate from the objects. Admitting this contradiction, attraction, in order to produce effects, should pass from one thing to another, and in the case of gravitation as is explained by the hypothesis of attraction, when a body is attracted, as the authors say, by the sun, for instance, and between that body and the sun there are some other bodies interposed, these do not intercept the action, because attraction, they say, passes to the other side! If we were to admit this action at a distance, we would also be obliged to connote that the real agents of the system are removed by attraction throughout all the space of the universe. But nobody can arrive at an understanding of the real sense or the possibility that things could act at a point where they are not, no more than it can be intelligible that an object acts in the time during which it does not exist. When one thing is said to attract another, that is, when it is said that one thing acts separately from another, this is, we repeat, to attribute absolute omnipresence to everything, which will lead to the false conclusion that there is no more right in saying that objects and their particles are in any one place than to say that they are in another, for the reason that the objects are referred to the place of their activity. Then, the same object could be in one place and all places at the same time, and so be considered as an Infinite Being, but as the infinite cannot be anything in the series of phenomenal determinations, and as these are what give us a knowledge of the objects, the result would be the paradox of denying the existence of matter.

Accordingly, there can be no such thing as Universal Attraction so-called; and so we group acts of this kind under the denomination of *Atomic Gravitation*, which is simply a mechanical effect resulting from ethereal (progenic) impulse.

§ 22. PHYSIOLOGICAL OR PHYSICAL CHANGE.

In a material sense, *i.e.* in the objective world, *change* implies causal continuity; in fact, *change* is only a different mode of the manner of being, object, which is always dynamic, and constantly keeps a relation, that is, a law in whose succession the passing from one condition to another determines the present, and this the future; *change* would otherwise involve contradiction to the idea of identity in the thing itself through all its mutations; that is to say, it would affirm that a thing could be and could not be at the same time. For our understanding material change is nothing but a quantitative relation, and from this it results that it does not demand any other foundation than consistency in the field of thought. Physical or material change has no real signification as an existing thing; its meaning is figurative, making the ellipsis or omission of the object; there is nothing really existing as change alone, the objects themselves are those which change in their movement as they vary in the modes of their activity.

Neither change in general nor change of movement in particular can be defined except by terms which express the same idea as that which we try to define, the subject and the predicate being synonymous or tautological expressions. Change, like the other ultimate notions of our understanding, cannot be derived from any other; mental reflection forms its concept only by experience, so that it cannot be communicated by words; thus we observe that cosmos is in perpetual or continuous change, all its parts following an order of antecedents and consequents in which a second term or effect becomes a first term or relative cause and so on. But our senses cannot discover all the changes of nature, and it happens also that the incessant reproduction of a similar change may produce in our minds the appearance of a constant situation or absolute repose. From this arises the relative distinction between potential and manifested changes, calling the last phenomenal. We must not forget that for reason at least, if not for the senses, potential changes denote activity, and consequently actuality as well as phenomenal changes. Again, we repeat, we must admit and recognize that natural knowledge is not under the control of irreflexive experience; that what is called also positive knowledge lies beyond sensual observation, and that there only the highest power can penetrate; with this motive, and in accordance with Greek etymology, we may say that among the changes some are "phenomena," and others "noumena," giving this last qualification to those which are under the control of reason, though this derives them by reflecting on the phenomenal or manifested antecedents. Objects thus succeed each other in this eternal change of cosmos, so constituting a continuous process in which some changes are often discovered in a manner manifest to the senses, while others appear as latent or imperceptible, and from this arises the distinction already established between phenomenal and potential states of matter.

How can we amalgamate change and unity in things? ask the philosophers. They resolve this question either by denying change, as do the eclectics, or by denying unity, as do the heraclitos. Some factor in things must remain relatively fixed or permanent in order to make known to us their constant individuality; in truth the knowledge of the notion of change reveals to us the existence of some factor, which from its greater constancy serves as a standard of comparison for the more mutable changes. It is a contradiction to affirm that there can be absolute identity and absolute change at the same time, but identity and change are not incompatible in objective relations; that is to say, when a thing changes it is and is not the same before and after the change, because it is neither equal nor different in absolute, it is only so in a relative sense, for change does not consist in an absolute transference of things from one to another; it only varies relations at a time. In this question most metaphysicians maintain an ontological idea which is quite arbitrary and opposed to scientific understanding. They say that a thing cannot exist in different states, because, when it takes on a new state it is transformed into a new thing; but, in physiologic science above all, we understand that when water, for instance, changes its state, though it is not the same in absolute in one state as in the other, we always estimate it as being the same thing—water, but in a different state. The ontological error before stated arises from the false conception of being which controls all the systems of transformism, and the conclusions of such ontological thoughts are that objects exist in an incessant progressive change in the perpetual process of nature, that objects themselves force one another to pass to different forms, that nothing rests in the same state; and so the transformists say "everything is constantly transformed, things as they appear being only the links in an eternal chain, or a transient ebb and flow in the current of the world, all passing and ending thus except the change in the things themselves." But if all could pass in this manner, even the law of correlation of quantity could not remain, as it is nothing independent from the reality of the things themselves, it being only a mental abstraction. So we see that such an erroneous conception of change is one proof more against transformism.

In every part of nature we find only effects, and we must add that these effects become in turn causes, not primordial but derived; but we never find in the changes of the physical world either the prime cause or the ultimate effect; every object must be conceived as a cause in the mechanism of nature, but as an effect in universal organism or system. For this reason the expressions cause (excepting the Creator), effect, and change are relative; still more, change in a physical sense denotes variation in the sole form of activity of which nature is capable, that is, movement.

§ 23. INERTIA OF MATTER.

What has hitherto been said in this chapter obliges us to give a correct scientific interpretation to the word inertia, because in its etymological sense it is a contradiction to the concept of persistent activity of matter. We cannot acquire the idea of action in things if we suppose them absolutely inert, nor can we comprehend the changes in nature if we consider it as constituted of particles completely at rest, because in order to be perceptible a thing must determine an action of which it is the proximate cause, for all sensual ideas must necessarily have cause and effect, that is to say, actor and action; so we insist on affirming that a concept of absolutely inert matter is an erroneous abstraction of our irreflexive experience. Matter may appear to the eye as inert or as a recipient of action, but our reason penetrates into the truth that such an idea is a contradiction, because anything acting on that which is supposed to be absolutely passive could not determine reaction, and therefore is an impossibility for our rational intelligence. Thus we have seen that when an object appears to be in repose or inactive, reflection teaches us that it follows in a state of incessant activities which are neutralized or compensated because they act in contrary directions; that is to say, repose is an equilibrium resulting from the opposition of energies in a part of the universal system arbitrarily limited for our views and purpose. In cosmos all is in incessant activity, and everything is in the most complex connections with all others as the result of intermotion; hence sensation or irreflexive experience deceives us when it accepts the existence of passive objects. The dynamic conception of matter is the only one which in its elemental as much as in its massive form affirms the reality of nature as it exists; that is, always in activity or movement.

Accordingly inertia cannot signify absolute passivity; analyzing its law we discover in it a double meaning. In one sense it denies the spontaneity of matter as to change in its relations of space; this signifies that matter is never an automaton, and that a body, in order to change its place, must be impulsed by another, but inertia does not imply that the material elements are lacking in relative and derived activity, for the constituent parts of bodies are in mutual action, and liable to a great variety of changes. We must always keep in mind that every visible thing is constituted of many invisible parts, and that the law of inertia, although connoting these parts, only expresses what appears to the experience of the bodily whole. In the other meaning the law of inertia states that ponderable matter offers resistance to change in its relations of space; the phrase "force of inertia" being derived from this fact, although there is a contradiction in its own enunciation, and such a resistance of ponderable matter is a true force useful in mechanics, and therefore implies activity.

Hence, the word inertia has not the same signification in the scientific or technical as in the ordinary or vulgar sense; in the technical sense it does not exclude the idea that all matter must have power, activity, or energy, relative and derived, of course, although many times observation does not directly reveal to us the sensation of movement, nor that of change. It is a truth that the law of inertia thus interpreted is perhaps the best established fact in Physiology, and it can be said that all universal mechanics or the whole theory of Physiology is based on it, the results of experience being constantly true in accordance with this law.

Some philosophers and physicists, with the aim of excluding the immaterial from the universal system, have proclaimed as a principle that the law of inertia is a necessity of thought; they say that our understanding can immediately penetrate the idea that a body is inert, that is to say, that a body cannot stop moving of itself; that if it is in repose it must necessarily continue in repose, and if it is in movement it will continue moving with uniformity in a straight line unless interrupted by the interference of some other body. Such a law is only the abstract expression of mechanical facts, and therefore it cannot be qualified as an evident principle by itself, that is as a necessity of thought by its simple enunciation. If we observe that a fact occurs in a determinate manner, this does not permit us to affirm that the fact must be so in the absence of true proof. Although there is not sufficient evidence to deny that an element if existing alone in space could come into movement, as movement is the expression of the relation in space and time among objects, the isolated existence of a particle in empty space is an idea opposed to reality, because the particles have their existence and properties only in the system of which they form a part. The sole use of such an illusion is to inculcate the law of inertia in the mind, but it must never be considered as an argument; and yet nobody can affirm that an element alone in space could be capable of existing in movement. We may say the same about the persistent direction of movement which is affirmed by the law of inertia; therefore there is not sufficient reason in this enunciation to consider it as an evident truth. Furthermore, the fact of the law of inertia is a corollary of the principle of conservation according to which a natural force can neither produce nor destroy a definite movement in its direction or in its velocity. Again, if we consider the facts of experience as they are, we never see anything in the world which always remains in absolute repose, nor do we see anything in the world moving with uniform velocity and in a straight line. Therefore, the law of inertia does not account for the constant changes of the natural existence of things in variable movement; it takes movement separately as a figurative abstraction, and from mere fictions and impossible cases derives the deductions for reality; the idea of system is then overlooked by those who, intending to find in nature supreme laws, commit at the same time the peculiar paradox of denying the existence of the universal system, which needs the government of a supreme intelligence, the only one that can be causal law. All scientific laws, including that of inertia, express only some relation of mechanical effects.

The realization of abstractions is nothing in material reality, and nothing can be imagined or can be conceived as resulting from it; therefore it is as impossible to construct an object by a synthesis of abstract forces as it is by the aggregation of corpuscles absolutely *inert* or *passive*. Everything in the universe is subordinated to the purpose and fixed aim of the Creator, who continually determines the manifested activity of nature by inorganic generation; in organism the transformation of potential (not manifested) changes into actual or phenomenal is constantly produced; we can never find in any object the principle of such constant activity; this always results from the propagation of movement among objects, and this is the true idea of the inertia of matter. Hence inertia does not presuppose want of effected, but of causal activity; the difference between the agency of life and the inertia of matter is that the former produces manifested generation, while inertia in bodies only shows propagation with phenomenal loss. Death does not signify annihilation, but a ceasing of the generation of "living force," which is the measure of manifested changes. In order that a latent change in a body should become patent or phenomenal some antecedent determining such conversion is necessary; the organisms are the only laboratories or machines for such a metamorphosis, in which there is profit or multiplication of disposable force, and therefore the true Primordial Cause of activity in the natural system acts directly in them. For this reason we have repeatedly said that the primordial effect in cosmos is organic generation, and accordingly from this all physiological phenomena must be derived.

Inertia essentially presupposes force instead of being its opposite term, as appears from the etymological sense and vulgar application of the word. Even the definitions of the ancients express correlation between inertia and force, although, like most of our contemporaries, they were under the control of the same ontological error. Thus, in accordance with Newton, many authors have defined inertia as an inherent force of matter, by virtue of which matter has in itself the power to resist any change from the state of repose and of uniform rectilinear movement. Some modern authors, trying to reconcile the vulgar with the scientific sense of the word inertia, say that matter is powerless to change its situation of repose or of movement on account of the effect of the resistance of mass—that is, of the quantity of matter considered as resistant to the communication of movement. This is neither more nor less than the definition of Newton ; it declares the fact, but leaves it without explanation.

Absolute inertia, like passive matter or mass in absolute, is nothing. If for a misinterpreted illusion we try to conceive a body as isolated in absolute—that is, alone, without any connection with others, we cannot obtain even the idea of a passive body, because all manifestation results from the mutual action among bodies, and therefore a truly passive object could not be anything perceived by the senses—that is, it could not be known to us.

The law of inertia embraces the animate as well as the inanimate world, the organism of rational as well as of irrational beings. All propagations of material activity are engendered, but how we do not know; we can only say that organized matter is as incapable as inorganic is of originating or producing a primordial activity. Accordingly, the law of inertia simply denies spontaneity in nature; a change of material conditions is always an effect which presupposes some cause with reference to the relations of space and time, and nothing more.

§ 24. CONSERVATION OF ENERGY: ULTIMATE PRINCIPLE OF MECHANISM.

Movement and repose are not opposite facts, but a purely relative distinction, although we may consider any object in the universe either in repose or in movement, according to the point we take as a standard of comparison. Nevertheless, it is a common occurrence with philosophers of nature to suppose they can conciliate in thought the absolute reality of movement and repose with their apparent phenomenal relativity. To heighten this error, some have admitted in space a centre or point in absolute repose, to which they could refer the position of all bodies in absolute; but this is no more than an expression of chimerical language, abusing its power by making it express even the inconceivable—phrases without any signification of course being the result. Movement is the general fact that has been recognized in all mutation or material change, whether the energy is or is not manifested directly to our senses. It is the ultimatum in our understanding for the interpretation of phenomena and potentiality of nature; beyond that our rational experience cannot reach. Movement, being an abstraction, cannot be anything primordial; there must exist some why or wherefore in order that objects should move. Observation proves to us the constant loss of mechanical force; for if a constant reparation were not experienced in the world all physiological manifestations would soon cease. From this true concept of material inertia we infer the ultimate induction of mechanism—the principle of *conservation of energy.*

To find the general law or sole synthesis of the material world has always been the unanimous desire of the great scientists, and a comprehensive law of all cosmic mechanism has been found in the quantitative relation of the following law, which denotes only a relative unity; in nature there is conservation or persistence of the same quantity of moving matter. Reason proves that this great principle of quantity called "conservation" is a true and just one, and not a chimerical aspiration of science, because though phenomena are constantly manifested as newly engendered, it is only by propagation of latent or potential into phenomenal energy. Hence such a principle of conservation, like the law of inertia, simply means that material energy is never annihilated nor created in absolute, but the conservation of energy in its actual state is the effect of a supreme act upon organism.

In apparent opposition to this unity of Cosmos, observation supplies us with a multiplicity of qualities of objects which are separately perceived by irreflexive mind as different sensations altogether. Our consciousness, in truth, perceives the different sensations as if

they were many primordial properties, and consequently in the attributions or qualities we do not find any reason common to all objects which could explain the unity of cosmos; such a reason we find only in objective relations. Let us now see what kind of relation explains such a unity. We know that the establishment of a relation or proportion of quantity needs at least two perceptions, and the act of mental repetition gives us the idea of number—that is, the difference between unity and plurality. We also know that quantity can be either discrete or continuous. With discrete quantity the combinational operations of mathematics or algebraic calculations are made; and with continuous quantity the extensional operations of geometrical studies. It can be said that we see in nature infinite forms of extensional or continuous quantity, while combinational or discrete quantity, in which abstract number is implied, supposes invariability. Besides, extrinsic or objective perceptions can be quantitatively compared; but intrinsic or subjective perceptions cannot be admitted to comparison under the standard of abstract number. Hence the capacities of the mind cannot be mathematically calculated. This can be done only with the acts of the material world, which are manifested by the senses as natural phenomena, and which are collected by our understanding as a basis for natural science—Physiology—under the principle of conservation with the standard of abstract number. This means that all physiological energies—phenomenal as well as latent changes—are the effect of matter in movement, this being always equal in its total force, energy, power or intensity; and this is the true mathematical reason of the relative unity of cosmic mechan-

ism. If there is always the same discrete amount of matter in movement in cosmos, we can derive from such a principle all the other physiological laws which are considered by authors as primordial laws of nature. Calling R and F the cosmic energies, comprehending those in a latent state as well as those manifested, we can condense this law into the formula R = F, that is, the resulting energy of a change equals the force employed to produce it. But this axiom of persistence, or conservation of energy, needs a universal reason; this is the vital or organic postulate called the principle of *uniformity of nature*, which must depend on the existence of only one primordial power—that is to say, on the absolute unity of the Supreme. Hence we proclaim a true scientific monotheism, according to which only one cause of uniform involution of inert matter exists, and that is the Creator. Cosmos as mechanism is a simple machine which, in order to develop its functions, uniformly needs a governing power; but this does not come within the province of Physiology.

In fine, the principle of the conservation of energy is neither more nor less than the law of inertia, and represents but a generalization of the facts of inertia of matter. To understand it thoroughly needs the full study of this work, and for this reason we reserve for the last chapter and conclusion the complement of its explanation.

CHAPTER III.

PONDERABLE MATTER: ATOMIC THEORY.

§ 25. Real existence of atoms—§ 26. Disagreement among atomists—§ 27. Atomic properties so miscalled—§ 28. "Unity" erroneousl derived from atomism—29. Recapitulation of the concept of atoms.

§ 25. REAL EXISTENCE OF ATOMS.

In this century the atomic hypothesis has been the conception of most general application to the study of nature, and yet the determination of the atom is a problem impossible to solve. Most modern physicists and chemists consider the question of the atom as solved with evident proofs, founding their belief in the assertion of the practical limit of the divisibility of bodies from which we cannot pass by the physiological or physico-chemical actions which are at our disposal.

Many philosophers, and some physicists also, on the contrary, fight against the atomic hypothesis, saying that matter is absolutely continuous, and therefore that space is completely full. The chief and pretentious idea of the non-atomic hypothesis is to establish more surely the fantastic notion of the pure individuality of things. Those who maintain such an idea say that the concept of matter is one alone, and that for this reason we must take into consideration all objective things as being also one without any discontinuity, because, they add, the plurality of things is owing only to accidents or modifications of matter which is always one and the same thing. But what has continuity to do with identity? Such an idea does not need further comment to show the evident falsity of the arguments on which it is based; and, besides, the concept of absolute continuity of bodies is contradicted by true empirical laws. Again, although the limits of objects are only relatively known (as we have seen in treating of extension and impenetrability) we can do no less than admit continuity in a minimum limit, otherwise much would be left unsaid in the explanation of phenomena and other material changes.

Although almost all scientific writers actually admit some kind of atomic hypothesis, it is necessary to determine the true limitation of atomism by interpreting it in connection with the principles of reasoning and those of empirical observation. The material necessary to form a true atomic hypothesis is disseminated in the most admired disorder; but we must be just, and add that, thanks to modern scientific investigations, within that chaos already exist all the materials which must contribute to the formation of a true physiological theory. We aspire to reach our purpose by following a logical method which is here completely proved, seeking what is true in this intricate labyrinth, and setting aside what we judge has been falsely asserted.

Here we must make special mention of two great errors maintained by most physicists. The *first* is the contradiction of endowing atoms with forces as the causes of their activity, and at the same time admitting as true the fact of inertia of matter. We have explained how this is opposed to the direct light given by reflective speech, for matter is either inert or has causal forces, but both things cannot be at the same time, as there is a contradiction in the very words. This, then, is an error which becomes patent simply by an explanation of the terms. The truth of inertia has been clearly proved by merely interpreting the empirical determination of the acts of matter; and, on the other hand, it has also been demonstrated that all the physical forces are effects and not causes; that they are the result of the mutual action of things which are but matter in movement; and that they have no real existence as things, being purely mental relations, that is, comparative determinations of quantity.

The *second* great error of atomists is to affirm that all matter is atomic. We will show in the next chapter that imponderable ether or progene cannot be atomic, being distributed in parcels of very variable quantity—indiscriminate or indefinite quantities of progene.

With this brief criticism, and the data of the foregoing chapters, we are prepared to acquire a true conception of atoms, so proportioning an idea in harmony with the unity of all physiological science, and in harmony also with a true metaphysical theory; because physiological theory must be perfectly subordinate to the high concepts of the immaterial, in the psychical as much as in the theological sense. This is the only true method of scientific speculation; to follow any other is to try vainly, so to speak, to let in a ray of light at the expense of mental blindness, the result being an illusory clearness, as the eyes of the mind see less afterwards by the pretended light of positivism than they did before.

§ 26. DISAGREEMENT AMONG ATOMISTS.

We cannot assent to atomism in its present chaotic state, as authors disagree in the interpretation of the atomic theory in the different departments of physiological science, explaining the facts of every one separately without connection with the other. But cosmos being a harmonic system, a similar view must be taken in all the theories of hypotheses whose end is the same, that is, the explanation of the mechanism of nature. There can be no intellectual satisfaction in the atomic hypotheses given up to the present day by writers on Physics and Chemistry, because every one of them, being circumscribed only by predilection to one physiological branch, graphically interprets the empiric determination of very limited generalizations which are called laws, and which have no other advantage than the practical value of helping the imagination and memory, though without giving more than illusory explanations of the generation of physico-chemical changes, that is, of Mechanism.

The atomic hypothesis, we said, has been described in different and contrary terms according to the end every author had in view. Thus, in molar or ordinary mechanics, atoms are considered endowed with inertia, absolutely passive, without taking into account either gravitation or the other actions of bodies which physicists and chemists suppose to be produced by atomic or molecular forces. The astronomer sees the atoms as simple centres of attraction without preoccupying himself with the admission of imponderable means; so he thinks all is based on the "law of attracting gravitation" according to which every atom or group of atoms is supposed to attract every other with an intensity which varies in a fixed relation according to masses and distances. The chemist settles the scientific base of chemistry without any connection with the theories of imponderable physics; he prescinds the idea of mechanical necessity in the metamorphoses of bodies, and endows atoms with a special elective force—*affinity*—without recognizing the influence of imponderable matter in anything, explaining the corporeal relations by an atomic limitation completely baseless. On the contrary, the physicist, properly so called, that is, he who is specially devoted to the study of imponderable changes, recognizes imponderable matter as a necessary principle, though this is very differently comprehended by every author, and is generally endowed with absolute elasticity, rotatory movement, etc.; he admits atoms as constituents of bodies, either endowing them with limited extension and molecular forces, or as pure dynamism maintains, considering them as imaginary points where the resultants of universal forces act, and from this arises the erroneous conclusion that forces are the only existences in cosmos. We must remark also that the limits given to atoms by physicists who admit the corpuscular hypothesis are entirely different from those determined by chemists. The mineralogist introduces, besides, new concepts and other atomic forces principally in order to explain crystallization; and finally, the biologist names one force more of a specific character and elective reaction—*irritability*—which is considered entirely different from chemical affinity, though this, they say, is also elective.

The hypotheses of atoms have a long history, these having been invented by the earliest scientists, and having already reached the rank of a doctrine among the ancient Greeks. But the elaboration of an atomic hypothesis chemically explained was based by Dalton on the discovery of definite and multiple proportions; he proclaiming that the fixed ponderable proportions in which bodies are combined (equivalence) depend on the relations of weight among the constituent atoms. Chemical atomism afterwards received an apparent confirmation by Gay-Lussac's discovery relative to the definite and simple proportions of the components of gaseous combinations. Dalton's idea has been applied to this fact by declaring that the weights of the volumes of gases which are combined are in relation with atomic weights; observing, then, that a simple relation exists between the so-called atomic weights of gases and their densities. The entire existing theory of chemistry is founded on this atomic hypothesis thus elaborated. Let us ask, then, what is the reason of Dalton's assertion, which is deduced from the idea that bodies are combined by numeric equality of atoms. Having selected hydrogen as the standard unity, Dalton has said that the weight of the atoms of the other bodies, as oxygen, for instance, is in the same proportion to the weight of the atoms of hydrogen as are the weights of the respective bodies in their combination forming water. There is no reason for this conclusion, because it is a common occurrence that the same components form different combinations, and it is not possible to suppose that in all their combinations there is an equal number of atoms in the components; if the elements have the capacity to combine without equality in the number of atoms, why, then, should we suppose such equality, even when elements do not form more than a compound?

Accordingly, the atomic hypothesis as conceived by chemists may, perhaps, be of great descriptive value, but it does not explain anything in the field of phenomenal genesis. Because masses combine in proportions of definite weight Dalton and his followers say that the atoms must also be proportionately definite in weight; but there is no reason in explaining definite proportions and equivalence of components by the averment that the weights of the atoms are in definite proportions, for this does not give any additional knowledge; it is only a confusing play of words.

What has been said is enough to prove the lack of unity in, and the falseness of, the atomic hypothesis of authors, considered according to their own explanations. All the facts of nature must be united under one theory alone, comparing them one with another so as to derive a universal generalization; for science must not be satisfied with partial opinions which only lead it into the existing labyrinth of innumerable conceptions of nature, and which result in a physiological theory so imperfect and abortive. A true theory must comprehend the whole cosmos as a real system; it is therefore necessary for the establishment of a valid and complete theory to compare the facts of the present hypotheses in order to demonstrate the fallacy of the atomic conceptions of cosmos, not only because it is impossible for a scientific understanding to entertain the idea that every department of physiological theory conceives atoms as vehicles of forces and with different characters, but also because it is impossible to consider atoms as the material unity or reason for substantial identity, and for the uniformity of nature.

This work is not the proper one in which to discuss for the interpretation of phenomena and potentiality of nature; beyond that our rational experience cannot reach. Movement, being an abstraction, cannot be anything primordial; there must exist some why or wherefore in order that objects should move. Observation proves to us the constant loss of mechanical force; for if a constant reparation were not experienced in the world all physiological manifestations would soon cease. From this true concept of material inertia we infer the ultimate induction of mechanism—the principle of *conservation of energy*.

To find the general law or sole synthesis of the material world has always been the unanimous desire of the great scientists, and a comprehensive law of all cosmic mechanism has been found in the quantitative relation of the following law, which denotes only a relative unity; in nature there is conservation or persistence of the same quantity of moving matter. Reason proves that this great principle of quantity called "conservation" is a true and just one, and not a chimerical aspiration of science, because though phenomena are constantly manifested as newly engendered, it is only by propagation of latent or potential into phenomenal energy. Hence such a principle of conservation, like the law of inertia, simply means that material energy is never annihilated nor created in absolute, but the conservation of energy in its actual state is the effect of a supreme act upon organism.

In apparent opposition to this unity of Cosmos, observation supplies us with a multiplicity of qualities of objects which are separately perceived by irreflexive mind as different sensations altogether. Our consciousness, in truth, perceives the different sensations as if

they were many primordial properties, and consequently in the attributions or qualities we do not find any reason common to all objects which could explain the unity of cosmos; such a reason we find only in objective relations. Let us now see what kind of relation explains such a unity. We know that the establishment of a relation or proportion of quantity needs at least two perceptions, and the act of mental repetition gives us the idea of number—that is, the difference between unity and plurality. We also know that quantity can be either discrete or continuous. With discrete quantity the combinational operations of mathematics or algebraic calculations are made; and with continuous quantity the extensional operations of geometrical studies. It can be said that we see in nature infinite forms of extensional or continuous quantity, while combinational or discrete quantity, in which abstract number is implied, supposes invariability. Besides, extrinsic or objective perceptions can be quantitatively compared; but intrinsic or subjective perceptions cannot be admitted to comparison under the standard of abstract number. Hence the capacities of the mind cannot be mathematically calculated. This can be done only with the acts of the material world, which are manifested by the senses as natural phenomena, and which are collected by our understanding as a basis for natural science—Physiology—under the principle of conservation with the standard of abstract number. This means that all physiological energies—phenomenal as well as latent changes—are the effect of matter in movement, this being always equal in its total force, energy, power or intensity; and this is the true mathematical reason of the relative unity of cosmic mechan-

ism. If there is always the same discrete amount of matter in movement in cosmos, we can derive from such a principle all the other physiological laws which are considered by authors as primordial laws of nature. Calling R and F the cosmic energies, comprehending those in a latent state as well as those manifested, we can condense this law into the formula R = F, that is, the resulting energy of a change equals the force employed to produce it. But this axiom of persistence, or conservation of energy, needs a universal reason; this is the vital or organic postulate called the principle of *uniformity of nature*, which must depend on the existence of only one primordial power—that is to say, on the absolute unity of the Supreme. Hence we proclaim a true scientific monotheism, according to which only one cause of uniform involution of inert matter exists, and that is the Creator. Cosmos as mechanism is a simple machine which, in order to develop its functions, uniformly needs a governing power; but this does not come within the province of Physiology.

In fine, the principle of the conservation of energy is neither more nor less than the law of inertia, and represents but a generalization of the facts of inertia of matter. To understand it thoroughly needs the full study of this work, and for this reason we reserve for the last chapter and conclusion the complement of its explanation.

CHAPTER III.

PONDERABLE MATTER: ATOMIC THEORY.

§ 25. Real existence of atoms—§ 26. Disagreement among atomists—§ 27. Atomic properties so miscalled—§ 28. "Unity" erroneousl derived from atomism—29. Recapitulation of the concept of atoms.

§ 25. REAL EXISTENCE OF ATOMS.

In this century the atomic hypothesis has been the conception of most general application to the study of nature, and yet the determination of the atom is a problem impossible to solve. Most modern physicists and chemists consider the question of the atom as solved with evident proofs, founding their belief in the assertion of the practical limit of the divisibility of bodies from which we cannot pass by the physiological or physico-chemical actions which are at our disposal.

Many philosophers, and some physicists also, on the contrary, fight against the atomic hypothesis, saying that matter is absolutely continuous, and therefore that space is completely full. The chief and pretentious idea of the non-atomic hypothesis is to establish more surely the fantastic notion of the pure individuality of things. Those who maintain such an idea say that the concept of matter is one alone, and that for this reason we must take into consideration all objective things as being also one without any discontinuity, because, they add, the plurality of things is owing only to accidents or modifications of matter which is always one and the same thing. But what has continuity to do with identity? Such an idea does not need further comment to show the evident falsity of the arguments on which it is based; and, besides, the concept of absolute continuity of bodies is contradicted by true empirical laws. Again, although the limits of objects are only relatively known (as we have seen in treating of extension and impenetrability) we can do no less than admit continuity in a minimum limit, otherwise much would be left unsaid in the explanation of phenomena and other material changes.

Although almost all scientific writers actually admit some kind of atomic hypothesis, it is necessary to determine the true limitation of atomism by interpreting it in connection with the principles of reasoning and those of empirical observation. The material necessary to form a true atomic hypothesis is disseminated in the most admired disorder; but we must be just, and add that, thanks to modern scientific investigations, within that chaos already exist all the materials which must contribute to the formation of a true physiological theory. We aspire to reach our purpose by following a logical method which is here completely proved, seeking what is true in this intricate labyrinth, and setting aside what we judge has been falsely asserted.

Here we must make special mention of two great errors maintained by most physicists. The *first* is the contradiction of endowing atoms with forces as the causes of their activity, and at the same time admitting as true the fact of inertia of matter. We have explained how this is opposed to the direct light given by reflective speech, for matter is either inert or has causal forces, but both things cannot be at the same time, as there is a contradiction in the very words. This, then, is an error which becomes patent simply by an explanation of the terms. The truth of inertia has been clearly proved by merely interpreting the empirical determination of the acts of matter; and, on the other hand, it has also been demonstrated that all the physical forces are effects and not causes; that they are the result of the mutual action of things which are but matter in movement; and that they have no real existence as things, being purely mental relations, that is, comparative determinations of quantity.

The *second* great error of atomists is to affirm that all matter is atomic. We will show in the next chapter that imponderable ether or progene cannot be atomic, being distributed in parcels of very variable quantity—indiscriminate or indefinite quantities of progene.

With this brief criticism, and the data of the foregoing chapters, we are prepared to acquire a true conception of atoms, so proportioning an idea in harmony with the unity of all physiological science, and in harmony also with a true metaphysical theory; because physiological theory must be perfectly subordinate to the high concepts of the immaterial, in the psychical as much as in the theological sense. This is the only true method of scientific speculation; to follow any other is to try vainly, so to speak, to let in a ray of light at the expense of mental blindness, the result being an illusory clearness, as the eyes of the mind see less afterwards by the pretended light of positivism than they did before.

§ 26. DISAGREEMENT AMONG ATOMISTS.

We cannot assent to atomism in its present chaotic state, as authors disagree in the interpretation of the atomic theory in the different departments of physiological science, explaining the facts of every one separately without connection with the other. But cosmos being a harmonic system, a similar view must be taken in all the theories of hypotheses whose end is the same, that is, the explanation of the mechanism of nature. There can be no intellectual satisfaction in the atomic hypotheses given up to the present day by writers on Physics and Chemistry, because every one of them, being circumscribed only by predilection to one physiological branch, graphically interprets the empiric determination of very limited generalizations which are called laws, and which have no other advantage than the practical value of helping the imagination and memory, though without giving more than illusory explanations of the generation of physico-chemical changes, that is, of Mechanism.

The atomic hypothesis, we said, has been described in different and contrary terms according to the end every author had in view. Thus, in molar or ordinary mechanics, atoms are considered endowed with inertia, absolutely passive, without taking into account either gravitation or the other actions of bodies which physicists and chemists suppose to be produced by atomic or molecular forces. The astronomer sees the atoms as simple centres of attraction without preoccupying himself with the admission of imponderable means; so he thinks all is based on the "law of attracting gravitation" according to which every atom or group of atoms is supposed to attract every other with an intensity which varies in a fixed relation according to masses and distances. The chemist settles the scientific base of chemistry without any connection with the theories of imponderable physics; he prescinds the idea of mechanical necessity in the metamorphoses of bodies, and endows atoms with a special elective force—*affinity*—without recognizing the influence of imponderable matter in anything, explaining the corporeal relations by an atomic limitation completely baseless. On the contrary, the physicist, properly so called, that is, he who is specially devoted to the study of imponderable changes, recognizes imponderable matter as a necessary principle, though this is very differently comprehended by every author, and is generally endowed with absolute elasticity, rotatory movement, etc.; he admits atoms as constituents of bodies, either endowing them with limited extension and molecular forces, or as pure dynamism maintains, considering them as imaginary points where the resultants of universal forces act, and from this arises the erroneous conclusion that forces are the only existences in cosmos. We must remark also that the limits given to atoms by physicists who admit the corpuscular hypothesis are entirely different from those determined by chemists. The mineralogist introduces, besides, new concepts and other atomic forces principally in order to explain crystallization; and finally, the biologist names one force more of a specific character and elective reaction—*irritability*—which is considered entirely different from chemical affinity, though this, they say, is also elective.

The hypotheses of atoms have a long history, these having been invented by the earliest scientists, and having already reached the rank of a doctrine among the ancient Greeks. But the elaboration of an atomic hypothesis chemically explained was based by Dalton on the discovery of definite and multiple proportions; he proclaiming that the fixed ponderable proportions in which bodies are combined (equivalence) depend on the relations of weight among the constituent atoms. Chemical atomism afterwards received an apparent confirmation by Gay-Lussac's discovery relative to the definite and simple proportions of the components of gaseous combinations. Dalton's idea has been applied to this fact by declaring that the weights of the volumes of gases which are combined are in relation with atomic weights; observing, then, that a simple relation exists between the so-called atomic weights of gases and their densities. The entire existing theory of chemistry is founded on this atomic hypothesis thus elaborated. Let us ask, then, what is the reason of Dalton's assertion, which is deduced from the idea that bodies are combined by numeric equality of atoms. Having selected hydrogen as the standard unity, Dalton has said that the weight of the atoms of the other bodies, as oxygen, for instance, is in the same proportion to the weight of the atoms of hydrogen as are the weights of the respective bodies in their combination forming water. There is no reason for this conclusion, because it is a common occurrence that the same components form different combinations, and it is not possible to suppose that in all their combinations there is an equal number of atoms in the components; if the elements have the capacity to combine without equality in the number of atoms, why, then, should we suppose such equality, even when elements do not form more than a compound?

Accordingly, the atomic hypothesis as conceived by chemists may, perhaps, be of great descriptive value, but it does not explain anything in the field of phenomenal genesis. Because masses combine in proportions of definite weight Dalton and his followers say that the atoms must also be proportionately definite in weight; but there is no reason in explaining definite proportions and equivalence of components by the averment that the weights of the atoms are in definite proportions, for this does not give any additional knowledge; it is only a confusing play of words.

What has been said is enough to prove the lack of unity in, and the falseness of, the atomic hypothesis of authors, considered according to their own explanations. All the facts of nature must be united under one theory alone, comparing them one with another so as to derive a universal generalization; for science must not be satisfied with partial opinions which only lead it into the existing labyrinth of innumerable conceptions of nature, and which result in a physiological theory so imperfect and abortive. A true theory must comprehend the whole cosmos as a real system; it is therefore necessary for the establishment of a valid and complete theory to compare the facts of the present hypotheses in order to demonstrate the fallacy of the atomic conceptions of cosmos, not only because it is impossible for a scientific understanding to entertain the idea that every department of physiological theory conceives atoms as vehicles of forces and with different characters, but also because it is impossible to consider atoms as the material unity or reason for substantial identity, and for the uniformity of nature.

This work is not the proper one in which to discuss for the interpretation of phenomena and potentiality of nature; beyond that our rational experience cannot reach. Movement, being an abstraction, cannot be anything primordial; there must exist some why or wherefore in order that objects should move. Observation proves to us the constant loss of mechanical force; for if a constant reparation were not experienced in the world all physiological manifestations would soon cease. From this true concept of material inertia we infer the ultimate induction of mechanism—the principle of *conservation of energy.*

To find the general law or sole synthesis of the material world has always been the unanimous desire of the great scientists, and a comprehensive law of all cosmic mechanism has been found in the quantitative relation of the following law, which denotes only a relative unity; in nature there is conservation or persistence of the same quantity of moving matter. Reason proves that this great principle of quantity called "conservation" is a true and just one, and not a chimerical aspiration of science, because though phenomena are constantly manifested as newly engendered, it is only by propagation of latent or potential into phenomenal energy. Hence such a principle of conservation, like the law of inertia, simply means that material energy is never annihilated nor created in absolute, but the conservation of energy in its actual state is the effect of a supreme act upon organism.

In apparent opposition to this unity of Cosmos, observation supplies us with a multiplicity of qualities of objects which are separately perceived by irreflexive mind as different sensations altogether. Our consciousness, in truth, perceives the different sensations as if

they were many primordial properties, and consequently in the attributions or qualities we do not find any reason common to all objects which could explain the unity of cosmos; such a reason we find only in objective relations. Let us now see what kind of relation explains such a unity. We know that the establishment of a relation or proportion of quantity needs at least two perceptions, and the act of mental repetition gives us the idea of number—that is, the difference between unity and plurality. We also know that quantity can be either discrete or continuous. With discrete quantity the combinational operations of mathematics or algebraic calculations are made; and with continuous quantity the extensional operations of geometrical studies. It can be said that we see in nature infinite forms of extensional or continuous quantity, while combinational or discrete quantity, in which abstract number is implied, supposes invariability. Besides, extrinsic or objective perceptions can be quantitatively compared; but intrinsic or subjective perceptions cannot be admitted to comparison under the standard of abstract number. Hence the capacities of the mind cannot be mathematically calculated. This can be done only with the acts of the material world, which are manifested by the senses as natural phenomena, and which are collected by our understanding as a basis for natural science—Physiology—under the principle of conservation with the standard of abstract number. This means that all physiological energies—phenomenal as well as latent changes—are the effect of matter in movement, this being always equal in its total force, energy, power or intensity; and this is the true mathematical reason of the relative unity of cosmic mechan-

in the perpetual movement of gravitating atoms on the other, the result being that atoms which, like masses, are really inert, are conceived by them as things endowed with proper activity. Thus, some authors have imagined that atoms are whirlpools containing an invariable quantity of imponderable fluid, having also permanently a certain and inherent rotatory movement of their own, and that, in consequence of such movement, when atoms collide they repel each other as perfectly elastic bodies would; but we must remark that perfectly elastic bodies do not exist in reality, and therefore that even this standard of comparison is imaginary. This hypothesis, besides affirming a supposition contrary to the law of inertia, cannot explain any sensible difference in movement, and would therefore oblige us to admit the conclusion that there are no phenomenal changes in nature, so denying precisely the contrary of the facts these same authors try to interpret —changes of propagation of movement in accordance with the principle of conservation.

Some physicists, though admitting the inherent rotation of atoms, consider them not as ethereal fluid in movement, but as real corpuscles, supposing that when atoms collide they keep the same quantity of movement in the sum of their rotation and translation, there being then only a conversion in the form of movement but without any loss, thus strangely affirming that atoms have always the same power. All experience demonstrates the contrary, as even when bodies possessed of the greatest elasticity (which is never perfect) collide in such a manner as to produce the most complete repulsion possible they lose at least a third of their movement; and this is without taking into onsideration the cases in which there is almost a complete loss of rotatory as well as of translatory movement. Hence we see that to attribute rotation to atoms in order to endow them with inherent and perfect elasticity does not explain the purpose for which it was intended, that is, the reparation of the loss of living force in mechanism, without contradicting the principle of conservation of energy.

Ponderable matter must be truly considered of atomic constitution, composed of discrete particles, that is to say, of corpuscles which are separated either in part or totally by imponderable matter or progene, the expansion of a body being the result of the augmentation of the intervals relatively occupied by progene, and its contraction the result of their diminution. Nevertheless, such particles cannot be defined in their minimum limits, any more than in any other property, by chemical laws or by any other means. The molecules which compose the different chemical elements have a determined specific weight or equivalence of combination in harmony with the definite constitution of the bodies combined, that is to say, with the definite and multiple proportions of the components in combination. From these relations and laws chemists especially pretend to determine atomic limits and properties, which is an impossibility.

The indestructibility of ponderable matter is a truth ttested by the balance, which shows us that all the hanges to which bodies are submitted are simply hanges of form, the relation of mass or quantity of natter always remaining invariable. But, at the same ime, we must keep in mind that weight, and therefore nass, is not an absolute property, but a relation determined by comparison, and which, as the pendulum demonstrates, varies with the position of the body with reference to the centre of gravity of the earth. It is necessary to bear in mind that the atomic weights of Dalton simply represent the relations in weight according to which bodies are combined, the arithmetical ratio of the numbers being ordinarily proportional or equivalent; but with this no atomic limits are determined.

Many chemists have also tried to determine the volume of atoms, deducing it from atomic weights, dividing the quantities which express the atomic weights of every chemical element by their densities, *i.e.* by the weights of the unity of volume, and, in this manner, they believe they have obtained the volume of atoms. But if we admit that ponderable matter is discrete, that is to say, that atoms are separated by greater or less space, such quantities represent the relations of atomic parcels, comprehending in these parcels not only the atoms, but half of the space which separates them from one another. We must not forget, then, that the unities of volume that we call atomic parcels are not completely occupied by ponderable matter alone, they also contain imponderable matter or progene. We must elucidate in a similar manner what are called the molecular volumes of a combination, and which it will be better to name molecular parcels. These are determined by the sum of atomic volume which we have called atomic parcels. If the atomic and molecular parcels contain not only ponderable corpuscles but also imponderable matter in movement, the energy of this matter must then be a factor of chemical metamorphosis, although, until now, it has never been determined. Nevertheless we can already make some conjectures from the progressive discoveries of thermo-chemistry, as we have shown in our "Theory of Physics."

In all ways the Daltonian determination of atomic weight by supposing equality in the number of atoms when elements are combined lacks favourable proof, because what is right to affirm from the fact of the multiple proportion is that the numbers which represent the quantity of atoms in an element common to different compounds are usually in arithmetical relation, that is, 1, 2, 3, 4, 5, etc.; but there is no determining from this what must be the precise number of atoms which can be put for such a relation in chemical combinations, and consequently the so-called atomic weights, we repeat, represent a relation in the equivalence of bodies in combination, and nothing else.

§ 28. UNITY ERRONEOUSLY DERIVED FROM ATOMISM.

Authors differ in opinion on the concept of atomic identity. Many say that the atoms of bodies, considered as different elements in Chemistry, cannot be of the same nature, while others affirm that all must be constituted of the same primordial matter. It is necessary to understand what they desire to express by the phrase "matters of different nature," but remembering the signification of the words *qualitative nature* and *essence* of matter, we obtain the true concept of qualitative identity of atoms and of all matter. Nevertheless, we must not fall into the error of considering the atom as the cause of unity in the universe.

Here it is well to remark the difference between chemical elements and simple bodies. A *chemical element* is the minimum mass of homogeneous constitution, which is chemically determined by the relative weight of combination; while a *simple body*, though chemically homogeneous, may or may not correspond in its mass to its chemical equivalent. Nevertheless, when there is no such equivalence the relation is multifold. Chemical elements are all different from one another (in quantity of course), while the term simple bodies makes no reference to quantitative relations which may or may not be equal. Hence, the different chemical elements are not things without mutual relations; on the contrary, they form a series whose terms are in regular gradation in conformity with some law or quantitative relation plainly appreciable though not yet exactly formulated. One relation yet exists which is common, not only to all chemical elements, but also to all bodies whatever their quantity may be; this is the equality of densities of all ponderable matter when we take progene (imponderable ether) as a standard, which fact is proved by the falling of all bodies with the same velocity within a tube from which the air has been exhausted. These facts, united to the consideration of simplicity in the idea, a thing which is so attractive to the mind, are at least good reasons, though not complete proofs in favour of the admission of but one primordial matter; and though up to this time experience does not permit us to expect the practical possibility of a metamorphosis of all simple bodies into one alone, we have settled in the introduction that all objective differences, that is, all the actions which are known by propagation through the senses, are quantitative, the differences of quality arising in the mind itself through the various reactions provoked by sensation. This is the highest argument and sufficient proof in favour of the identity of matter, for how is it possible to recognize ponderable matter of different qualities, if such matter cannot be propagated through the nervous system in order to be perceived by the mind? It is not possible, for what the mind receives from the object is in reality either the propagation of movement or the transmission of progene, and therefore objective differences can be quantitative alone.

Physiological Theory starts from the facts of experience or extrinsic observation; the mind groups such facts and brings them under laws of generalization in accordance with their connections, and these laws express quantitative correlations which must be mathematically expressed in order to be scientifically exact. Hence, though every simple body were constituted of atoms of different qualities, the result would be the same for our understanding as if they were all constituted of atoms of the same quality, for, we repeat, no other differences but the quantitative can be known by the data of the senses, that is, physiologically.

Most authors say that the atom is a permanent element which continues in bodies, though they are constantly passing through many different states and conditions, and that this permits them to affirm that a body is the same through all its changes; but we have seen that the so-called properties of matter, and therefore those of constituting atoms, are relative, depending on the mutual action between the objects of nature and the mind; this interaction varies with many circumstances, principally with that of relative position among atoms when there are changes between the proportions of centripetal energy (gravitation) and centrifugal (heat). Thus some bodies, though chemically equal, may be in other respects different, which can be explained only by the collocation of their constituent, invisible corpuscles, according to the energy of the imponderable matter acting in contact with such corpuscles.

By inferring the ultimate abstractions of the object, we arrive at the conclusion that the two universal attributions—substance and activity—are of the same nature throughout all cosmos; and for this same reason, although the reduction of all chemical elements to one alone is practically impossible, to assimilate all to the same substance is a theoretical necessity; because the fact that all the differences among objects are quantitative, truly implies the reason of substantial identity among all bodies and among all their constituent parts, whether they are ponderable (atomic matter) or imponderable (progenic matter). We have thus proclaimed the similarity of essence or qualitative nature in all objects, and in consonance with this idea it seems we have answered the practical question which has tormented thinkers from the earliest age of science: this is, the problem of the possibility of the transformation of matter into a single element, the resolution of which was vainly tried by alchemists. The results of irreflexive experience in chemical analysis are practically contrary to this idea of analogy in the quality of bodies, because there are more than sixty different kinds of elements which cannot be resolved into one another, and for this reason they are considered as simple bodies within the limits of chemical analysis. This proof is not sufficient reason to consider them as indivisible or irresoluble in mental speculations, and there are many facts besides which induce us to see fundamental connections among the simple bodies. Among other facts, we must keep in mind that the slightest change in the numeric relations of elements produces the greatest changes in our qualitative perceptions. It is possible then to conceive the chemical species obtained by actual analysis as elemental in a series of varieties of a single substance, which differ only in their relation or atomic and progenic dynamism; but this possibility of descriptive analogy must not be confounded with the monomania of evolutionism, which does not accept anything as already made or created in such a state, because even if the idea of material equality could some day become a practical fact, this would not advance the speculative assertions of transformism; for the true unity of the system consists in the unity of principle and plan alone, and not in similarity of material—substance and activity. Neither must we confound the physiological phrase of material similarity with the ontological phrase of common substance, because this is only an abstraction born from irreflexive experience on account of the fact that many different things can be made of the same material.

We must conclude this article by settling the fact that the atom is no more than a concept taken from quantitative relations, the atomic idea representing the last generalization of ponderable matter; but atom cannot be the concept of material unity, because, besides the foregoing reasons, imponderable matter is not atomic, as we shall see in the next chapter; and the progenic parcels, as well as the atoms, are real parts of the whole cosmos, and they must be considered, not as passive substratum, but as things in activity.

§ 29. RECAPITULATION OF THE CONCEPT OF ATOMS.

Physicists, by their opinions on the concept of matter, are generally divided into two parties, both standing on a false basis—that of realizing an abstraction: one is the corpuscular school, and the other the dynamic. The first in particular occupies our attention, for it is generally admitted by most authors, the second being set outside the pale of consideration, for it is absolutely groundless.

Atomism conceives all matter as formed of passive diminutive corpuscles endowed only with extension—atoms, or what is the same, a pure mass to which forces are aggregated, and so it pretends to explain the identity of matter, considering the atom as the common element and principle of unity. Only by verbal speculation can we arrive at the supposition that such material entity is simple or elemental, without distinction of quality of any kind, equal or identical in all things, but we must not admit that the atom is an agent or unity in itself. According to atomism, everything should be an aggregate of such atomic entities—that is, a particularization by means of special marks, owing only to differences of numeric quantity and geometric forms of atomic aggroupation. If they consider the atom as simple, elemental, and existing in and by itself, they recognize it as a universal being, extending this supposition to all objective things, which, according to their view, are only formed by collections of atoms.

We must explain that which appears to be by that which really is, but the concept of atomism does not follow such a maxim; besides, it is contrary to the exigencies of science, and is so deficient that we cannot derive from it the explanation of any cosmic or physiological manifestation. Furthermore, it is notably strange that even the most eminent physicists agree in maintaining that the weight of atoms, though unknown in absolute, must be primordial, inherent or persistent under all conditions of position and combination; and chemists wholly deduce their present atomic hypothesis from such an erroneous assertion. Since the time of Dalton the hypothesis of chemical atoms has been considered as a true interpretation of the laws of definite and multiple proportions, it being supposed that the relations in weight according to which the bodies are combined represent the weight of the most diminutive particles called atoms. The system of atomic weights as adopted at present is based on the discovery of the law of volumes (Gay-Lussac), and most chemists add that the cause of the definite proportions in which bodies are combined when they form different compounds, is that all the atoms corresponding to the same species of elemental matter are equal and indivisible. These may be necessary conditions, but not the cause of such a law. Chemists also maintain that when different molecules move to form a combination, it is because they are mutually attracted—because they have affinity; but this is not to interpret a phenomenon, it is simply to say a combination occurs "because. . . ." In the literal sense affinity is a selective causing force, and at the same time universally engendered; that is to say, a force inherent to matter considered sometimes as endowed with sympathetic attraction, and at others with antipathetic repulsion. This is a contradiction to the principle of conservation of energy and to the laws based on physiological facts. Such an impossible notion about abstract forces in mechanism must be superseded by the theory of direct impulse of matter whose variable parcels (progene) and indivisible particles (atoms) are in intermotion.

We must consider atoms as corpuscular elements having some invariable form, but with relative penetrability in their corresponding porocular spaces, which are occupied in part by the progenic parcels. Thus conceiving the atom, we can perfectly explain the phenomena presented in bodies—that is, the physical and chemical changes, or, better to say, physiological changes—but thus we do not resolve in any manner the problem of Genesis or that of Primordial Causality.

We must not think with the atomist that the properties of all bodies result from the accumulation of atoms; these are not absolute unities, they are only relative; we cannot discover in them more than a secondary activity, and that is movement, which in abstract cannot be more than an idea of quantitative distinctions or relations, as the qualitative distinctions or attributions of objects exist only in the mind of the spectator through the differences among the sensations there formed. Again, we must not consider atoms as in mutual absolute independence, but as dependent and subordinate particles in which there is no proper cause to produce in the natural order the combinations for the collocation of matter in the acts of vital generation. The most primordial effects of the order in the material system we shall find only in organic existence or vitality.

If the sole mode of change in atoms is movement, in this must consist the difference among the so-called atomic properties. Therefore, to determine the properties and forms of bodies we must directly refer, not to similar properties and forms of atoms, but to their dynamic relations with progene as well as among themselves, including here also "solidity," and, of course, extension and penetrability, which must undoubtedly be products or dynamic results, and not immutable attributes. Atoms cannot be considered as endowed with absolute or immutable extension, because in separating from one another, in some measure as an effect of the changes in progenic oscillation, they acquire the control of more or less space, and from this arise thermic variations in volume. Neither can atoms move from their places without the interference of some forcing power; this is equivalent to saying that the qualities of bodies which we may comprehend under the term "materiality" depend as proximate effects on the mutual action of ponderable and imponderable elements, and not on properties inherent to atoms. Furthermore, atoms could, perhaps, statically, completely fill space, but being then in a passive state they could not represent or reveal anything to our perception; in order to produce sensations they must be in activity or movement—that is, dynamically—in which state it is impossible to imagine the absolute fulness of space. In fine, in the phenomenal world or manifested reality, even extension and penetrability (in atomic parcels as much as in bodies) are variable as a result of the changes of movement, which vary in quantity or intensity according to the energy, not of one part, particle, or parcel alone, but in accordance with the interaction of all those which act in contact. The properties of atoms, then, depend proximately on their interaction with progene, and the objective primordial effects are those of vitality;

the generation of movement in the form of manifested changes is not an atomic property; it is the primordial effect of the Supernatural Cause, which, in order to produce all the phenomena of cosmos, acts directly upon living matter alone.

CHAPTER IV.

IMPONDERABLE MATTER: HYPOTHESIS OF PROGENE—ETHER OF THE PHYSICISTS.

§ 30. Real existence of progene—§ 31. Nature of progene—§ 32. Distribution of progene—§ 33 Forms of progenic motion—§ 34. Progenic potence—§ 35. Progenic phenomena—§ 36. Recapitulation of the concept of progene.

§ 30. REAL EXISTENCE OF PROGENE.

We give the name *progene* to the imponderable fluid or metafluid which physicists call *ether*. The change of denomination is made on account of greater etymological propriety in the use of the word *progene* (first engendered), because the progenic potence which moves ponderable particles to form organic matter is the *first* change *engendered* in nature, and because with this new name we avoid on the one hand the false concepts attributed by physicists to imponderable ether, and on the other, the equivocal ideas of the old name which not only represents ponderable bodies of definite composition in Chemistry, but also is commonly applied to immaterial things.

Some authors have denied the existence of imponderable matter, presuming that they could found a physiological theory of all the changes of nature by admitting ponderable matter alone. For this purpose they were obliged either to endow matter with inconceivable properties, or to give a real and exclusive existence to the abstract idea of force. Those who admit in cosmos only ponderable or atomic matter, fall into a scientific idolatry in which the forces are considered as causal instead of being merely mechanical resultant, but we have already dethroned all the false gods of the scientific Olympia which were born of the absurd ontological idea of admission of properties as absolute conditions of matter and of forces as real existences combined with some passive substratum. In confirmation of what has been said in opposition to such ontological ideas we will demonstrate in Part II. that it is an error to consider the abstract idea of *gravitation* as the fundamental cause of phenomena; we will see that this force is the resultant of the interaction of progene with corpuscular matter and not a causal force.

We must now remove the irreflexive doubts which exist respecting the admission of progene because this has not the sanction of the sense of touch which gives more apparent certainty for the admission of objects. It is in truth a false assertion of irreflexive minds that the complete contents of the notion of matter are obtained directly by means of the perceptions of the senses, or what is the same, that we do not know anything as to matter apart from extrinsic ideas, or ideas directly presented by sensation; it is thus imagined by many writers that all science of matter is directly acquired by immediate experience, adding to this that the same writers consider such knowledge as the sole one, indisputable in its evidence, and deny certainty the true proof of the ideas which are not immediately resented to the senses. But although the phenomenal hanges, that is, those manifested to the senses, are what reveal to us material activity, they do not compose the whole of such activity, because this is found also in a potential, virtual, or latent state, as is proved by the actions of expenditure or forces of position which oblige us to recognize the existence of a potential or non-manifested energy. Again, we have already said (in the psychological data) that sensation is only the immediate idea formed by the mind in its capacity of feeling, by propagating through the nerves the interaction between matter and the senses, and that the theory of knowledge also authorizes us to admit and recognize some things in nature though they are beyond the direct reach of our senses. Thus, for instance, there are tenuous gases which escape our direct observation; they can be neither touched nor seen, yet they are recognized by their effects in chemical interaction with other bodies; and the changes which then take place, and not the bodies themselves, are those which are evident to the senses. Thus, also, there are infra-red and ultra-violet rays of light, better said of progene, which cannot be perceived by the eye; there are vibrations from sonorous instruments which, being either defective or excessive, cannot be perceived by the ear; etc., etc.

Though sensation is the immediate effect of the capacity of our mind to refer our knowledge of matter to the senses, and though it provokes mental reaction it may be a deceitful illusion produced by want of reflexion. Sensations are the data for reflection, and the witnesses for our reason in order to assent to scientific judgments and to derive from these the conclusions which form the physiological theory, that is, all the abstract knowledge of nature together.

We have repeatedly said that physiological knowledge comprehends not only phenomena, but also the potential changes which reason can discover after their transference into manifested changes; and that physiological problems cannot be resolved by the exclusive use of the senses but by reason. The theory of nature is of a rational solution, therefore it is speculative and not a fact of irreflexive observation; the difference between physical and metaphysical theories is that in the latter the fundamental data are those of intrinsic intuition or proper consciousness (abstraction being made of experimental incitants), which is contrary to that occurring in the physiological or physical, whose base is only a mental reference to the incitants experienced, abstraction being made of the states of consciousness which provoked them. We will conclude with this statement, that material as well as immaterial knowledge is always reflexive or rational, and not in any manner irreflexive or sensual.

Those who are opposed to the idea of the existence of imponderable matter make use of the argument that it is not an object of sensation. This is not true, but even if it were it would not be a sufficient argument to deny its existence, according to the summary idea which we have given relative to the acquisition of material knowledge. But is there any one so obstinate that, from a spirit of contradiction to all that is rational, he dares to deny that he sees light? Do not all feel also the rays of light when they estimate their heat? An ellipsis of language has conduced to an error of reference, taking the extreme instead of the medium, because, strictly speaking, we do not see nor touch the sun itself, what we feel is the action which is propagated to us determining the impression of the senses, and such a propagation cannot be nothing, it must be something capable of provoking sensation, *i.e.* matter of some kind. Granting this, and knowing also that ponderable matter encircles the earth only to the extent of about sixty miles, there yet remaining many, many miles between the earth's atmosphere and the sun, we must necessarily admit some material thing there to propagate the physiological action of solar radiation, or in better words, *solar propagation.* Furthermore, rational experience shows us the analogy between many changes that happen within the limits of our planet and those of solar propagation, proving at the same time the impossibility of the propagation of such changes through ponderable matter; and from this we conclude that metafluid or imponderable matter is not only matter which exists in the greater part of interstellar space, but also a constituent of terrestrial objects. All molecular and imponderable changes, like heat, sound, light, and electricity, induce us to believe that *progene* (not in absolute but relatively) fills all the empty spaces of ponderable matter, that is, occupies intermolecular as well as interstellar space.

It now only remains for us to combat the objection made against the admission of progene because it has no weight. The balance is not the only means of proof for the admission or rejection of a material substance. Who can ever weigh, for instance, the odoriferous particles of musk? Progene has not been weighed, and besides never will be weighed, because it is the proximate cause of the weight of bodies. The balance is only an instrument to determine a relation of the atomic resistance to some movements of progene, which are determined by the circulation of matter in living bodies, and with such relations we can form a correlative scale of weights in which the zero corresponds to progene, or imponderable ether of the physicists. Therefore the irreflexive opinion which considers the production of the sensation of pression in touch as a necessity proper to material existence is completely groundless. Progene is not a body offering resistance to the touch, nevertheless it is necessarily a constituent material common to all bodies. We repeat that there are many substances well recognized even in the laboratory of the chemist, which, like progene, do not offer resistance to touch.

§ 31. NATURE OF PROGENE.

Innumerable are the facts which demand the admission of a perfectly fluid matter, capable of propagating movements in perfect accordance with the so-called law of fluid pression. This matter, moreover, not being subordinated to the condition of gravity, can freely propagate an impulse in a straight uniform movement so long as it is not disturbed in its propagation by the interposition of some other substance.

As in atoms, the extension, penetrability, elasticity, and other properties of progene, are only relations or quantitative factors of matter in movement; thus, for instance, the more reduced the progene in the amplitude of its movements the less penetrable it is; and it would become impenetrable (that is, absolutely reduced to its minimum extension), if it could be in complete or absolute repose, but this is impossible in reality, because there is no part whatever which can be considered as isolated from the others with complete independence, and so, at least, it must have some degree of heat. For this reason progene apparently acts as if it were a repulsive or elastic force in the interstices of bodies.

In accordance with the chemical processes in which it is observed that bodies are combined in definite proportions we have deduced the atomic constitution of ponderable matter, and in accordance with thermic, sonorous, luminous, and electric changes, we infer that imponderable matter is not atomic, though it keeps in reciprocal relation with ponderable matter in the quantity of its transferences. This is one reason more for affirming that imponderable matter is equal in quality to ponderable matter. The laws of chemical combinations—heat and weight—are indeed very regular, as their relations are always, or with rare exceptions, whole numbers, and generally the smaller digits. This shows us, we repeat, that for the necessary propagations of such changes between the two kinds of matter the ponderable particles (atoms and the other molecules) are equal in quality to progenic substance, the difference being only one of quantity.

Ponderable particles, then, can be conceived as formed by condensation of progene, that is, atomic corpuscles can only differ from progenic parcels and these among themselves, either numerically or geometrically, in quantity. Thus in the description of cosmos (without reference to its real genesis) we give the priority to progene or imponderable matter, considering ponderable matter as a condensation of this, some vacuum resulting in the world as the effect of such condensation; anticipating here that such a change must have been engendered by the Primordial Cause, not mechanically produced by matter itself, because it supposes generation of living force instead of the loss which is produced in all the acts of mechanism. This descriptive idea of evolution of matter, beginning with progene, though only an imaginary hypothesis in genesis, assists the mental representation of nature in its ultimate analysis, and is besides in conformity with facts.

Progene or primordial matter preserves its discontinuity in parcels indefinitely divisible but simple, and for this reason it cannot be mutable in its composition, though it can be within the porocules in different dynamic conditions, and in different quantities in relation with the molecular and electric states of bodies. In this way progene, occupying the empty space of ponderable matter, is the cosmic medium for the propagation of action to any distance, in interstitial as well as in interstellar space. By its means the changes which authors in general refer to attractive and repulsive forces are produced; but because of this we must not consider it as a generator; it is only a propagator.

We can add, in conformity with the proverb *union is strength*, that the quantity of progene supposed to be condensed to form an indissoluble corpuscle or an atom is manifested by the mechanical acts of gravitation among which passive resistance, so-called, is principally recognized. This resistance, then, is the result of a greater mechanical energy in atoms than in a quantity of progene of the same volume, when a propagation takes place between them, and this is the reason of the transference of the movement of interstellar progene into gravity when it collides with the atmosphere and the other constituents of our planet.

Permanent oscillation which we have denied in molecules must be recognized in progene, not as primordial but as derived, for it is engendered by the potence of vitality. Physicists who are at present in accord in maintaining the error that the molecules of bodies are in permanent agitation in order to produce heat and sonorous transmission, also agree in admitting an inherent agitation of imponderable matter, but to maintain the kinetic property of matter, whether this is ponderable or imponderable, is a contradiction to the principle of Conservation of Energy and its correlative Law of Inertia; because ponderable matter, neither in its indivisible particles nor in its bodily condition, can be withdrawn from the action of gravity; neither can we withdraw progene from the resistance of particles composing ponderable matter. Where, then, is that inexhaustible fountain of causal force which we would be obliged to suppose in all bodies, if the kinetic hypothesis were true, in order to preserve the same movement in the molecules during all the time the bodies remain without change of temperature? In fact, manifested changes of temperature imply molecular movement; but the agitation which must be produced during the non-manifested changes, as conservation and radiation of heat, must occur in *progene* alone, and not in ponderable particles, because otherwise there could be no correlation of energy between the antecedents and consequents of such changes. Molecules only move in the phenomenal changes that heat produces in bodies, that is, in the changes of volume and state as the effect of variation of temperature. The kinetic conception, which is an impossibility in the case of molecules, is not applicable to progene either; nevertheless, progene must persist in constant oscillation in its interstellar as much as in its interstitial position, because otherwise somewhere we should practically find the absolute zero, or complete lack of heat which is a condition that can never be realized; and progene, being without weight, is kept in such motion by the constant and sudden propagations throughout its parcels of the change generated by the cause of vitality.

Rotation, which is so complex a movement, has been erroneously predicated as a property of all atoms, and also of progene; and some great scientists think to explain in this manner elasticity, so that it may account for the loss of living force in mechanism. This supposed rotation of every atom draws after it, they say, the ether (progene) in its corresponding parcels, so producing porocular whirlpools, and by means of such an imaginary primordial rotation they try to explain physiological changes, especially those of physical state and chemical metamorphoses. But what is the origin of such a rotation? To admit such an inherent movement in matter is to recognize a physiological myth or occult power in nature. In fine, then, we must say that progene is an inert matter which, like atoms, does not possess any property, or activity in absolute.

We have previously resolved a question which it is here convenient to elucidate further. Is progene continuous or corpuscular matter? The difference between the phenomenal characters that are referred to progene and those of ponderable matter, principally in the propagation of velocity, compels us to say that progene or imponderable matter cannot be of atomic constitution.

We must state that progene is indefinitely divisible in such a manner that every progenic parcel is constantly exchanging portions more or less small with the surrounding parcels, and from this results an extraordinary lack of stability in progene. Therefore, practically (and theoretically, of course), there is no minimum limit of quantity in the progenic parcels like that which is recognized in ponderable matter by the fixed proportions of chemical changes. Hence progene is not formed of atoms, but neither must we suppose it as matter absolutely continuous, for then there would be no vacuum in the world; movement would be impossible in it, and quantitative changes in the most variable proportions could not occur as they are recognized in all progenic phenomena. Accordingly, every progenic parcel varies greatly in dimension, while the dimension of every atom must be invariable, though it is indeterminable. The principles of thermo-dynamics are also a positive proof in favour of the non-atomic hypothesis of progene. Nevertheless, the atomic hypothesis assimilates progene to the gaseous state, and, according to this, at the enormous pressure at which those who maintain the theory of luminous undulations suppose imponderable matter to move, specific heat should be much greater than in any of the gases at the same temperature, and then the minimum fixed by calculation should be still greater after the addition of the specific heat of bodies; but the minimum already calculated is much greater than the specific heat of the most perfect gases, as is demonstrated by the difference of their specific heat at a constant pressure and volume. This point is discussed in the Theory of Heat (see "Theory of Physics").

§ 32. DISTRIBUTION OF PROGENE.

The extension which a body apparently occupies, that is, the space which appears to the immediate observation of the senses as full of matter in continuity, contains invisible holes or hollows, void of ponderable elements—vacuum, though relatively full of imponderable matter or progene. This we admit and recognize by reason and not by the senses. We must not confound such invisible vacuums with those which are visible, though both are called pores; and in order to avoid such an equivocation, it will be more convenient to call *porocules* those which are invisible.

Progene is not uniformly distributed in the porocules, as we infer from the chromatic dispersion of refracting bodies, otherwise light would be transmitted always and everywhere regularly, according to the laws of propagation of movement. Such porocules, then, are not completely but relatively full of progene, which in its incessant revolutions must occupy now one part of a porocule and now another. From this it results that there are no determined points always vacant, that is, points that never contain progene; but, on the contrary, if any part at any given moment is empty, it is immediately filled with progene, those that are full then becoming vacant, and so on. Progene, therefore, moves in the porocules as the waves of the ocean come and go over coast-lands.

The discontinuity of interstitial progene in diminutive parcels, contrasts with the immense extent of interstellar progene in continuity; for in this great medium there is no reason to suppose a division into very small parcels like those of the interior of bodies, because there are no particles of ponderable matter there to divide progene. To understand this difference we have compared the interstitial progene with the water which is absorbed by the earth, and the interstellar with that which is accumulated in great masses; the former is distributed in discontinuous parcels, while the latter, like the water of the ocean, we see altogether in continuity. This idea of the distribution of water, which is so clear to the eye, is applicable by the light of reason to the distribution of progene, which is not so clearly perceived.

The lack of uniformity in the distribution of interstitial progene in every porocule is easily explained. Progene in its revolutionary movements in porocular spaces collides with the particles of ponderable matter, and with the whirlpool thus formed the central points of the porocules will almost always contain progene, while in the spaces near the particles its presence will be more interrupted. Thus we have resolved the problem of the discontinuity of matter by deciding to accept a fixed quantity or corpuscular constitution in the particles of ponderable matter, and a variable quantity or non-corpuscular constitution in the imponderable, which is distributed, not in invariable, but in divisible particles.

Here we do not need to treat further the question of the nature of progenic parcels, because we have said enough to induce us to consider all matter as one in qualitative nature or fundamental essence, and that ponderable or atomic matter is a condensation or solidification of progene in corpuscles so diminutive that they cannot be seen even by the aid of the most powerful microscope. Such corpuscles have been called atoms (which means indivisible), because they cannot be divided by any known manner, and so they are considered as the prime ponderable elements. Hence, progenic parcels differ from atoms, not only in their density, but also in their variability, either by continuous changes of aggregation or by division.

We have admitted and recognized the existence of progene in the vacuum where there are no atoms; but what is the proportion between the volume of atoms and the dimensions of porocular spaces? The most absurd ideas have recently been formed about the structure of bodies, principally in calculating the proportions between ponderable and imponderable matter. The dimensions of porocules in relation to those of molecules cannot be calculated; nevertheless, in a manner inadmissible in any light, some physicists have exaggerated the dimension of the intervals, comparing them with interstellar distances in relation to the magnitude of celestial bodies. Others, trying to be more explicit and moderate, have said that the relation in water between the space occupied by the molecules and that occupied by the porocules is as 1 : 22; while others mark a relation almost the reverse of this, in which the cipher of the particle is ten times greater than that of the porocular space, that is, as 10 : 1. For the present this problem is merely planned, its solution necessitates a complete comparative study of the densities of bodies with their differences of dilatation and change of state, experimenting with heat; and above all, greater perfection is also necessary in spectral analysis. Therefore, in order to obtain sufficient data for the solution of such a problem, we must at least have some base for a standard of comparison for all bodies, and such a base can only be acquired by a perfect thermochemical and spectroscopical study of the elements. Above all we see in the spectral analysis of the future with the combined aid of the microscope, the light which will contribute to clear up and make known to us the intimate constitution of bodies. Now we may advance as a probability that the volumetric proportions between atoms and progene are: in gases the volume of progene must be more than twice as much as that of atoms, in liquids such a ratio must be nearly 2 : 1, and in solids the ratio must be smaller; that is, the volume of progene in solids must be less than twice that of the atoms. We have inferred this from the differential condensation of both kinds of matter which is in the ratio 1 : 2; that is, the atoms are almost double the density of progene when they are in a space void of gases. But these data are not sufficient data to calculate the dimension of atoms with the aim of deducing that of the porocules, or that of the progenic parcels; and if we reflect on this, it seems impossible that a day will come in which we can gain such knowledge, remembering that we have to consider thousands of cellules in the length of a milimetre, the cellule being formed of parts of heterogeneous structure, and each part containing different immediate chemical principles into which molecules of different nature enter. Furthermore, we have demonstrated that it is an impossibility to determine the absolute or minimum volume of atoms by the methods that authors have pretended to follow to deduce theoretic or relative volume from atomic weight, but we have already indicated (and demonstrated more clearly in chemical theory) the vanity of such a pretension (see "Theory of Physics").

Accordingly, the extension and other properties of progenic parcels are as indeterminable to-day as are those of atoms, the properties of all matter depending on mere relations.

§ 33. FORMS OF PROGENIC MOTION.

We can now clearly explain what is meant by the relative *vacuum of bodies*, which is the principal point for consideration in the hypothesis of *progene*. Though the existence of this substance is not hypothetic, the reflections on how it moves or acts are hypothetical, because we must deduce the modes of its changes from visible movements whose knowledge is acquired from ponderable matter, and afterwards make an application of the ideas from ponderable to imponderable matter by means of deductions not in strict conformity with the rules of syllogism. In truth, in the substitution of terms for such conclusions there is no absolute identity, as the words "atom" and "progene" represent different things or conditions; we find ourselves therefore on hypothetic ground, and must strictly follow the precepts given in the *Introduction* in order to judge the validity of the ideas which we are going to expose. We agree to determine the possible forms of invisible movement, progenic as well as molecular, from those which are visible, relying on the two great guarantees—uniformity of nature and conservation of energy, or inertia of matter. Though we do not see the movements of progene, many phenomena induce us to believe that it moves, as it must, for instance, for photothermic propagation from the sun to the earth; and this movement must continue in accordance with the law of inertia or conservation, that is, without increase or diminution of itself. We must afterwards imagine the possible interactions between progene and ponderable matter, taking into account the difference of concurrence between them in order to approach the truth, because in molar mechanics the things in interaction have weight while in the interactions now under discussion we make reference to progene which is imponderable matter, and this, of course, may change the practical conclusions of our calculations. We also recognize the possibility of mutual progenic interactions by collision between parcels of different movement, and for this class of actions the conclusions of pure rational mechanics (making the abstraction of gravity) will be perfectly suitable; but we must establish this great difference that we must here consider the motor (progene) as perfectly soft and inelastic, instead of conceiving motors perfectly hard and elastic as the mechanicians do. In this manner we settle the basis, hypothetical, of course, of progenic mechanics, in order to infer from them the modes of movement altogether invisible, which, nevertheless, can be mathematically calculated.

Here we must notice a distinction between the relative vacuum of interstellar space, indefinite in its immense magnitude on the one side, and interstitial vacuum, also indefinite, because it is immeasurably small, on the other. Interstellar progene forms the universal means in which the planetary systems are immersed, and interstitial progene is that which permeates the interior of all bodies, penetrating into all the vacant spaces of ponderable matter as water permeates a sponge; so that atoms are immersed in interstitial progene as planets are in interstellar progene.

We know that all bodies have porocules (invisible pores) either in a minute honeycomb form (invisible cells) as in solids, or in a diffuse form as in fluids (liquids and gases). Bear in mind that when we say invisible we mean that which cannot be seen even by the aid of the most powerful microscope. The portion of progene which is within a porocule (more or less confined by atomic matter) we denominate *progenic parcel*. This has no fixed property and dimension, its instability is ultra-fluidic. This limitation of progene in parcels, though arbitrary and indefinite, helps us to imagine the results of progenic interactions, and of the interactions of such progenic parcels with the molecules or invisible particles of ponderable matter. Thus, for instance, when a progenic parcel receives an impulse it will travel in a straight line and in the direction of the impulse while passing through empty space, but the moment it collides with another progenic parcel, or with a ponderable corpuscle, the movement will change according to the multiple conditions of the case. Now, determining a concrete case, we can conceive a constant result; thus, for instance, progene colliding with the particles which confine a porocule will be in a kind of revolution in which it moves to and fro among such resistant corpuscles in different directions in accordance with the laws of incidence and reflection, every progenic parcel so being in an oscillatory whirlpool. Besides this, every progenic parcel undergoes continuous interchange with the parcels surrounding it, as in the case of a liquid filling many communicating cavities; and this condition could only fail if a body could be independent in the universe; but from this a pure theoretical condition of constantly uniform movement would result instead of the variable one which is the rule and necessity of phenomenal activity. From such an oscillatory movement of interstitial progene proceeds that force of apparently repulsive action called caloric, whose effects of corpuscular dilatation give the measure of temperature, and determine the physical states of bodies.

We can also imagine the result of another case of propagation in progene; such is that which depends on the intermotion of progenic parcels among themselves as the effect of an oft-repeated impulse in the same direction. An interrupted progenic emission must then result, constituting a progenic radiation which can be transferred into thermic action as the effect of corporeal or interstitial absorption, or perhaps better to say, the effect of its conversion into the oscillatory movements of the interstitial parcels. Progene can also determine luminous impressions on the retina if the conditions of such a propagating movement are sufficient in their amplitude and velocity.

We can also arrive at the result of the action of interstellar progene with the atmosphere. The air, like any other body, is constituted of ponderable particles and progenic or imponderable parcels. As in all gases the less the pressure on the particles the more separate they are; for this reason the higher layers of the atmosphere being less dense than the lower have the particles more separated. Thus, for instance, if we represent by capital P the progenic parcels, and by small *p* the aërial particles, we can illustrate the constitution of two different layers of the atmosphere in the following manner:—

Upper layer = P   *p*   P   *p*   P
Lower layer = P *p* P *p* P *p* P *p* P

When the first layer of the atmosphere is impulsed by the pressure of interstellar progene it must produce different results according as the points of collision are the progenic parcels, P, or the atomic particles, *p*; the parcels P, are driven with a velocity equal to the initial or interstellar impulse, while the particles *p*, being of more density than progene, diminish in velocity in proportion to their mass. The propagation of movement in the second layer undergoes a similar change, and calling the second layer that which has four times more particles than the first, the interruption of the velocity of the interstellar impulse will be there four times more than in the first layer. Hence, the propagation of interstellar impulse with its initial velocity, that is, across the progenic parcels, must be in inverse ratio to the square of the distance, while the propagation of the said impulse with its velocity interrupted by the particles must be in direct ratio to the square of the distance. The former relation is the law of radiating propagation, and the latter is the law of gravitant propagation; and in this manner the interstellar impulse is divided into photothermic action (light and heat) and gravity. For this reason the effects of gravitation are contrary to those of the repulsion of heat. By the effects of gravitation bodies and their particles approach nearer to one another, and from this results the appearance in cosmos of attractive forces which together are improperly called "universal attraction," and which are really the effects of progene circulation. The radiation of progene in bodies is easily transferred into progenic oscillation of the interstitial parcels (heat); and from this arises the constant opposition between the two resultants of interstellar action, that is to say, between the two opposite effects—namely, progenic radiation and atomic gravitation—which are displayed by the interaction of interstellar progene with our planet.

§ 34. BRIEF IDEA OF PROGENIC POTENCE.

The qualifications, potent, latent, or passive forces, are frequently employed in Physics to denote the capacity of bodies to make manifest, with the appearance of spontaneity, some of the actual, present, or active powers, known as phenomena of nature. Thus, when heat arising from a chemical metamorphosis is manifested, the chemist ordinarily says that heat was latent in the bodies in which the change took place. All latent or potential power is the effect of the distribution of progene, whose quantity and energy in any point can be greater or less in relation with the surrounding points, and the action of the force called latent or potential may be manifested the moment equilibrium is re-established (escaping, for instance, from the point where it was excessive towards that where it was deficient), and impressing the senses in conditions to be the object of perception. Thus bodies ordinarily preserve some degree of potential energy, which, when it manifests itself, produces determined thermic conditions ; this is principally recognized under the measure called specific heat, which differs in proportion according to chemical combination. Sensible heat or temperature is a manifestation of a mode of molecular movement which principally determines the dilatation or expansion of bodies, but besides this there is potential or latent heat ; *e.g.* a body in order to change its state of molecular aggregation from solid to liquid and from liquid to gas, consumes a great quantity of heat which is not sensible to the thermometer (potential heat), because the intermolecular distances have been increased in the same proportion as the oscillations of progene. For this reason thermic propagation keeps at the same degree during all the time a body is changing its physical state. The progenic energy which is consumed in becoming latent during liquefaction has been employed in a work of molecular separation, which consists in dividing the solid particles into liquid ones, and we have supposed * that every liquid particle must contain two atoms. A similar thing occurs in evaporation, or in the change from a liquid to a gaseous state, but the molecular separation is then carried on in a greater degree, leaving every atom separate from the others. Again, a chemical change is a heterogeneous molecular composition or decomposition, and no more than a continuation of the said thermic changes, which are necessary to produce the different physical states. But in order to explain the different physical and chemical states of bodies, authors have imagined the most impossible things. We have already said that matter cannot be conceived as endowed with movement inherent in itself; that we must recognize as a primordial truth in nature only the physiological law of conservation of energy, and of course the laws that can be derived from such an axiom, as the law of inertia. Notwithstanding this, most authors admit at present that the molecules of bodies are animated by different movements, and by vibratory movement in a permanent manner; that even solid bodies never have their molecules immobile or in repose, but are constantly in vibratory movement whose

---

* See "Theory of Physics," II., Heat.

amplitude increases with the temperature. To this idea we oppose that of considering the particles of a body in relative repose among themselves when the body undergoes no change of temperature, nor a change in its physical or chemical state; because if molecules cannot be abstracted from the action of gravity, being formed, as they are, of ponderable matter, how is heat preserved in a body though that body is protected by isolating means? In order to suppose molecules in constant movement, it would be necessary to recognize in them an exhaustless fountain of inherent force which we have proved to be inadmissable; moreover heat, manifested by the changes of temperature, must not consist in vibration of ponderable matter, but in the transposition of the particles among themselves; this translatory movement is only produced during the manifested changes of temperature and state, and when the change ceases the molecules rest in relative repose. What constantly vibrates, or better to say, oscillates, although it may remain in a potential state, is the matter of the porocules—progene—which does not lose its energy by the action of gravity because it has no weight, yet which, by its movements, determines the force of gravitation in condensed or corpuscular matter. But keep well in mind that the changes of progene are not primordial though they are persistent in nature; they emanate from organic generation. Such persistent oscillation and the irregular distribution of confined progene are the proximate causes of progenic potence, and therefore of all latent states.

Progene, condensed or accumulated in a potential state, can be set at liberty either gradually or instantly. In the first case it ordinarily produces light or photothermic irradiation and radiating heat; and in the second, besides these, it can produce sound and molar movements, forming the complex phenomenon called explosion. Photothermic irradiation results when the progene progresses in a diffuse manner, and with sufficient velocity to impress the retina; when the irradiation is not sufficient to produce a luminous sensation it is then simply thermic or radiating heat; this last may easily convert its translatory movement into oscillatory (interstitial heat) by collision with a molecular resistance sufficient to oppose progene in a diffuse course. Explosion results when the force of the progene instantaneously freed greatly exceeds the molecular resistance, so dispersing the ponderable matter in pieces; the greater the quantity of progene and the more instantaneously it is freed, the greater is the force of the explosion, just as in any molar force or mechanical energy whatever, which always increases in proportion to velocity (the other factors being equal).

Accordingly the term "latent heat," and the other latent forces of a similar kind, like electricity, will be advantageously supplanted by the phrase *potential progene.* We state in the "Theory of Physics" that what is called static positive electricity is nothing more than condensed potential progene, and static negative electricity is potential progene in rarefaction also confined in a body, both electric states being potential. The electric current is only latent progene passing in easy conduction from a point which is continually overcharged (effect of a chemical reaction, for instance), towards another point in which there is a relative deficiency. Magnetic phenomena are visible movements determined by continuous currents of progene, which are directed from condensed points towards others in relative rarefaction; so that magnetism is the most peculiar manifestation of electric transferences.

The explanations of all these facts are sufficient to lead us to infer that interstitial progene exists in very different conditions; that some is free within the bodies to manifest interchanges with the progene of other bodies, while some is confined within the body and is not manifested until a phenomenal transference takes place; in this last condition of confinement progene is potential. Furthermore, the quantity of progene existing in a parcel must vary in bodies with their changes of physical as well as of chemical state; thus, for instance, when a body changes from gas to liquid and from liquid to solid, it frees or eliminates some fixed quantity of progene, and on the contrary bodies absorb progene when they change from solid to liquid and from liquid to gas. Thus, also, some quantity of progene is absorbed in a direct combination of elements, while it is eliminated in a simple decomposition; from this arises the distinction of the changes of state of bodies into endothermic (with absorption of heat) and exothermic (with elimination of heat). Accordingly, in every change of state, some definite proportion of progene is evolved which may be called *progene of combination* or *combined progene* to differentiate it from that existing in variable proportions which may be called *mixed progene*—as electricity. In short, confined progene (progenic potence, whether combined or mixed, this being either condensed or rarefied) is the cause of the latent powers called electricity and potential heat (latent and radiating heat).

§ 35. BRIEF IDEA OF PROGENIC PHENOMENA.

Progene may be in a state either potential (latent) or phenomenal (manifested). We have already indicated the results of the former, it now only remains for us to indicate the results of the latter ; and here we will give only a slight idea of progenic phenomena in general, as the study of every progenic change in particular is given in our "Theory of Physics" (Chap. IV. Sound, V. Light, and VI. Electricity).

All phenomena, those of the inorganic as well as those of the organized world, are always produced by propagated movement. We must constantly bear in mind that to consider matter or its particles as endowed with elasticity and inherent movement is to suppose also the existence of an abstract or inherent force in matter which is really inert.

The degree of separation among the particles of the same body chiefly depends, not on attractive and repulsive forces, but on the intensity of the oscillations of the interstitial progene whose measure is the temperature of bodies. The different states of molecular aggregation that are called physical states, which completely change the conditions of penetrability in bodies, are also erroneously explained in Physics by one of the imaginary attractive forces called cohesion which we have set aside as we have done in the case of all the others in the abstract sense, limiting the meaning of the word force to the measure of movements produced in correlation with the law of inertia. When we employ the term cohesion it is in the sense of a secondary or concrete force, resulting from the interaction of progene and ponderable particles, and the degree of cohesion must depend on the preominance of the action of gravity over that of thermic r oscillating interstitial progene. The resultant of such predominating force of gravity is not constantly the same, the differences being the cause of the different modes of molecular aggregation from which result the four physical states of bodies, the innumerable chemical metamorphoses, and still more frequently differences of volume in the same body (changes of temperature). In a similar manner all phenomena are immediately derived from the movement of progene when they are not the effect of direct propagation from molar movement. Thus we must consider also as proximate effects of progenic energy the movements qualified as molecular, magnetic, and planetary.

In order to produce such phenomena, progene must exist in two forms of movement, oscillatory and translatory. It may be said that translatory movement is the simplest, as the oscillatory is no more than a return movement or a constantly repeated reverse translatory movement. Both forms of movement may occur either in diffuse or in confined progene, in accordance with which there are the two different states of progene—phenomenal and potential, each comprehending two different kinds of changes.

The two phenomenal states of progene, with the two states of potentiality, compose the four radical states f progene, which may be expressed in the following anner :—

1. Progene infiltrated in the interstices of ponderable atter in oscillatory movement, which, being transmitted n determined conditions of amplitude and velocity, can e perceived either by the ear, in the sensation of sound, r by the touch, in the sensation of heat.

2. Progene in translatory, radiating movement which, playing upon the retina with conditions sufficient to be perceived by it, produces the sensation of light; and when the conditions are insufficient to impress the retina producing only radiating heat. In the interstellar region both form the photothermic radiation which is the sole medium of all interplanetary actions.

3 and 4 are potential states, progene in confined current—dynamic electricity, and in tension—static electricity.

Electricity, in fact, is not phenomenal, because, although when transmitted to the nerves, it can be transformed into nervous action, it may produce the most different sensations according to the organ excited, but none of the sensations is characteristic of the exciting agent. For this reason progene in such states is not recognized by extrinsic sensation or irreflexive experience, but by reason, which estimates or appreciates a synthesis of manifestations whose proximate cause receives the name of dynamic and static *electricity*. Hence electric currents are not phenomenal but potential or latent, and progene in tension, called static electricity, like the currents now mentioned, cannot be directly perceived while it preserves such a state of tension; these states are recognized, not by themselves, but by their transferences into all possible forms of manifestation and principally by a phenomenal synthesis consisting in heat, explosion, electrical sparks, light, apparent attractions and repulsions, and so on.

Light and radiating heat are the sole movements that can be transmitted or propagated across interstellar progene; sound and electricity can be transmitted only by interstitial progene which pervades all ponderable matter, because, being propagated by conduction, some degree of progenic condensation is necessary in order to transmit them to any distance; such a condition is impossible to interstellar progene on account of its diffusibility.

Progene, in propagating movements to ponderable matter, produces phenomena which result from molecular movement, and also produces massive or molar movements. Molecular phenomena are of two kinds, calorific or thermic changes, manifested heat, effect of the oscillatory movement of progene, and chemical metamorphoses, effect of its translatory movement. Heat is the most frequent energy of molecular activity, and, for this reason, we may consider it as the typical energy and standard of comparison in the calculations of transferences. An inverse proportion exists between the thermic energy called heat and the chemical energy called affinity; but, though both kinds of molecular movements may result from each of the two forms of progenic movement, the transferences between the said energies cannot be direct in both cases.

Progene in confined currents must produce the molecular change of thermic effects by indirect transference, the translatory movement of the progene being then converted into oscillatory movement; and the reverse, progene in oscillatory movement cannot by direct transference determine chemical metamorphoses, for these require its direct influence in translatory movement. Hence the two kinds of molecular movements may be mutually transferred, not directly into each other, but by the intermediate concourse of the progene which needs to be set in the movement corresponding to the resultant molecular change. That is to say, heat, in order to produce a chemical change, first needs to transform the oscillatory movement of progene into translatory, and, on the contrary, a chemical change, in order to produce a variation of temperature, must first transform the translatory movement of progene into oscillatory. For this reason the final aim of progressive chemistry must be to supplant the modern thermo-chemistry by the electro-chemistry of the future.

As all phenomena can be produced by progenic changes, to comprehend at a glance the relation of phenomena in nature with the states of progene, we have formulated the following table:—

1. Directly, pure progenic phenomena.		Acoustic propagation : sound. Photothermic propagation : light.
2. Indirectly, by transference to ponderable matter.	Molecular Phenomena.	Change in inter-molecular distance: temperature and physical states of bodies. Change in molecular composition: chemical changes.
	Molar Phenomena.	Gradual and continuous transference (without noise): gravitation and magnetism. Rapid and noisy transference: explosion.

It is worthy of notice that the phenomena produced by restoring progene to a point in which it is in rarefaction are insignificant, and are ordinarily reduced to very limited molecular changes and magnetic movements. Progene in deficiency is the state called negative polarity, while progene in excess is the state called positive polarity; and this last is what determines all and every one of the phenomena with the greatest intensity and frequency. After what has been said we will better understand the effect of the resistance that ponderable matter opposes to imponderable matter in its continuous rushing across the universe, and from which results the illusory property of attraction which authors consider as inherent to all matter, that is to say, universal gravitation so called, on which the cohesion among molecules and the adhesion among masses depend, and which is also the proximate cause of the loss of living energy in the world's mechanism; as, in fact, there is always a loss of manifested force determined by the pressure of interstellar progene, the energy dissipated or lost becoming then of course latent.

Molar or visible movement, when not produced by another massive movement, but by something which is invisible, results from direct or indirect transference of progenic movement; thus the movement of falling bodies (gravity) results from the pressure of the progene which forms the interstellar ocean. The atmosphere, opposing some resistance to the progressive movement of interstellar progene, changes in part this progressive movement into interstitial oscillations, and these, being transmitted from the upper to the lower layers of the atmosphere, produce heat in direct ratio to the square of the distance, and this relation is inverse to that of the different masses of concentric spheres. The transference which most frequently occurs in the practical uses of industry is the production of molar movement by means of heat; the reverse transference, that of molar movement into heat, being also very well known. In both cases there is also a progenic change which is the intermediary between the molecular and the molar movement.

Progene, we repeat, must be in translatory movement in order to move the molecules, and thus it produces chemical metamorphoses, while in its oscillatory movement it produces the effects which are vaguely called by authors effects of repulsion, this being the cause of the great influence of heat in the decomposition of combined bodies. Progene must be also in translation in order to determine magnetic phenomena in the same manner as it is to determine chemical metamorphoses, and therefore we may say that chemical changes are in some manner like molecular magnetism.

§ 36. RECAPITULATION OF THE CONCEPT OF PROGENE.

Progene can only be admitted as a material medium, and therefore is only capable of propagations; we must conceive it as inert in the scientific acceptation of the word, that is, as a substance able to propagate motion without any power to increase or diminish it, being then subordinate to the principle of conservation of energy. Besides, progene is neither elastic nor dense, because both conditions are derived from the interactions of ponderable and imponderable matter. The hypotheses of imponderable ether, as conceived up to the present time, are contradictory to the fundamental principle of mechanism, because they endow the imponderable metafluid with inherent elasticity, and, according to this condition, it should be provided with a force of pressure proportional to its density. It is inconceivable that a perfectly simple and imponderable medium should be elastic, and still less that it should be dense.

Some scientists have fruitlessly endeavoured to explain the phenomena of nature without recognizing in cosmos anything but ponderable matter. We must admit a relative, not an absolute dualism in objective things, recognizing two kinds of matter, because some ropagations of changes in irradiation without visible novement, as sound, light, and radiating heat, and also he latent or potential, states, as electricity, can only be explained by means of an imponderable matter which we call *progene*. This matter, which is already actually admitted by almost all physicists under the name of "ether," to explain light, heat, and electricity, must also be recognized as the means through which sound is propagated. (This is explained in the "Theory of Physics," IV., Sound.)

Bodies, we shall see, are complex objects constituted by two fundamental forms of matter, ponderable and imponderable. Hence substances, actually considered as chemically simple, are simple only in a relative sense, considering ponderable matter alone. There is but one simple object in all nature; this is the interstellar progene—that is, the ultra-atmospheric metafluid which is generally recognized by physicists as the great ocean of imponderable ether.

We have proved the necessity of admitting in science qualitative identity among the things of nature, although this is not a fact of irreflexive experience. Reason teaches us that all objective difference is quantitative, and therefore that, within the reach of our perceptions at least, there is nothing perceptible in cosmos but the relations among the parts without any essential or attributive distinction. All changes appreciable to the senses—that is, physiological phenomena, progenic as well as molecular and molar—consist in changes of matter in movement derivatively produced by the mutual action of cosmic parts, the change effected being primordially in vital genesis. In the changes of nature, even in those called imponderable (progenic were a better name), there is mutual or reciprocal quantivalence: by this we mean, that the same force necessary to produce a determined consequent must be employed to effect the inverse change; that is, to produce that which was antecedent by means of the other which before served as a consequent. Progene, therefore, differs from ponderable matter in quantity only; the quality or essence of all objects is the same.

The constitution of imponderable matter has been very much discussed, some authors maintaining that it is atomic (discontinuous), and others that it is continuous matter. Neither of these two extreme opinions can be accepted; the arguments given in favour of the atomic idea prove no more than that there is no continuity in progene. The facts observed in progenic propagations induce us to conceive progene as distributed in parcels which may exchange matter among themselves without any limit existing to such divisibility. On the other hand, the admission of vacuum is as necessary to the theory of cosmos as is that of atoms themselves. In fact, vacuum is necessary in order that atoms and progene can move; yet it is not absolute, it is only relative; *porocular space is relatively full*, although in an interrupted manner, of imponderable matter or progene in movement. There exists, then, a relative vacuum among atoms which is not permanent, but which is successively occupied and interrupted by the constant change of position of imponderable matter —interstellar and interstitial progene in movement.

The propagations through interstellar progene must be instantaneous, including their two degrees, photothermic irradiations as the sunlight, and thermic as the invisible propagations issued from the planets. The sun, as a luminous body, is nothing more than a great focus of progenic reflection, transferring the thermic irradiations which are produced in the planets by living bodies, especially by animals, into photothermic irradiations or light. We will see in Part II. Chap. VII. that the sun has also some surface of thermic emission, but this is relatively very small. The sun has no proper force of attraction ; the changes of interplanetary gravitation we explain by the periodicity of vital activity, especially in vegetables, gravity resulting from the transference of ultra-atmospheric radiations of progene into movements of the mass of our planet. Accordingly the hub of material circulation is the potence of vitality, and not any force of solar radiation, nor any other of mere mechanical character, as gravitation.

This is not the opportune place to consider at length the parallel and difference between gravitation and the forms of radiating progenic action ; but we will make this distinction clear, in order to avoid confusion and to relieve ourselves from combating in detail most of the arguments which have been advanced against the concept of gravitation as explained by progene (imponderable ether). Gravitation, according to our hypothesis of progene, is a movement precisely opposite to that of radiation : it is a movement in which the resultant forces are approximated or concentrated in the direction of the propagation according to the ratio of the square oot of the distance ; while in radiations like those of ight, the resultant forces, on the contrary, are eccentric, eparating in the direction of propagation in the ratio of he second power of the distance. Thus, then, a power of radiation is centrifugal, while gravitation is centripetal ; radiation is an *efferent action from the centre,* and gravitation is the reverse, *afferent towards the centre of the sphere in action.* In spite of such opposition, the action of gravitation is not a thing absolutely different from radiation ; both are direct effects from the movements of the same intermediate agent—progene ; their differences are relative, and we have effectively marked as the sole distinctive character between them that they are opposite in their directions, from this alone arising two contrary effects in the interstices of bodies : radiation, which being eccentric or centrifugal, acts as a repulsive force in its molecular transferences ; and gravitation, which being on the contrary concentric or centripetal, acts as an attractive force ; and from this arises the physiological analogy between the phrases *universal attraction* and *universal gravitation*, which we have called *atomic gravitation.* We do not deem worthy of consideration the objection in regard to interplanetary gravitation made by Arago, who has said there is no reason to doubt that the action of gravity is instantaneous, and that if universal attraction were the result of the impulsion of a fluid, its action must need a definite time in crossing the immense distance which separates the celestial bodies. This criticism is fatal for the hypothesis which considers interstellar progene as of an atomic or absolutely discontinuous constitution, like atomists see gases when they are highly rarefied, but it does not in any manner affect the concept formed by us of interstellar fluid. This point will be further explained in Part II.

In fine our hypothesis of progene defends the truth of the organic theory in the primordial cause of phenomena, considering cosmos as an organism, admitting the Vital Power or Creator as the sole abstract or true causal force, rejecting the materialistic idea of considering the atom as active or passive in itself, and maintaining the existence of a universal means of propagation—progene—which is the first matter in effecting the acts of mechanical process, and which is the agent of indirect transferences when they appear to be produced by distant influences.

Here we will make no further explanation of progenic changes, because they form the special topics of *Progenic Physics* in our "Theory of Physics."

PART II.

SYNTHESIS OF COSMOS: SYNTHETIC CONCEPT OF BODIES.

MATERIAL substance is either ponderable or imponderable; the former is a condensation into diminutive indivisible, and indeterminable particles called atoms and the latter is the *metafluid* called "ether," by th physicists, and which we call *progene;* this last, i opposition to the indivisible corpuscles or atoms, is distributed into variable parcels. To form a complet idea of cosmos in its general sense we must make a application of the general concept of matter, not onl to its two fundamental forms separately, but we mus also consider them jointly in the constitution bodies.

This is the aim of Part II., and we shall see that th complexity of bodies is of different degrees forming fo syntheses, namely—

1. Inorganic bodies: atomic and progenic matt together forming bodies which are either solids fluids.

2. Organic bodies: solids and fluids forming togeth organisms.

3. Planetary bodies: inorganic and organic worl

ther forming great masses visibly discontinuous in r ponderable matter.

4. Universal system resulting from the union of all lies under a supernatural *plan*.

Every one of these different syntheses will form the ject of a separate chapter.

CHAPTER V.

CONCEPT OF INORGANIC BODIES (PONDERABLE AND IMPONDERABLE MATTER TOGETHER).

§ 37. Constitution of gases—§ 38. Kinetic hypothesis of gases—§ 39. Differences among physical states—§ 40. Slight idea of symmetrical bodies—§ 41. Chemical states—§ 42. Spectral analysis applied to the study of the constitution of bodies—§ 43. Recapitulation of the constitution of bodies, especially of gases.

§ 37. CONSTITUTION OF GASES.

Inorganic bodies are in four different states; two solid, and two fluid. Solid bodies are either symmetric or asymmetric, and fluids are either liquid or gaseous. The complete theory of the physical state of bodies cannot be known without a previous study of heat, because by heat only can we explain clearly and distinctly the differences and changes among these four states.

The genesic study of the change of state in bodies is given in the Theory of Heat, "Theory of Physics." Nevertheless we must now give the fundamental notions on the physical constitution of bodies, beginning with the descriptive study of gases which is the most interesting, because they are the simplest, and because the system of atomic weights at present generally adopted by chemists is based on the law of Gay-Lussac relative to the discovery of the relations of volumes among combined gases.

Bodies in their gaseous state appear to have an expansive force which consists in a centrifugal pressure, sensibly equal in all points of the vessel which contains them. Expansive force is almost equal in all gases when they have the same temperature and the same quantity of matter. For this reason the limit of volume of a gas is determined only by the resistance of the vessel in which it is enclosed, and if these limiting walls are so arranged as to reduce the capacity of the vessel we are obliged to increase the pressure according to this reduction of volume; that is to say, *the expansive force of gases decreases in proportion to their volume.* Again, there is another general fact: if we change the degree of heat of gases which are enclosed in a vessel constantly of the same volume we find that their *expansive force increases in proportion to their temperature.* Most authors have tried to explain these two empiric laws by the hypothesis of Avogadro, which consists in supposing that equal volumes of gas or vapour have the same number of molecules, these being proportional to the densities and having a volume double that of the atomic volume of hydrogen. In accordance with such an idea these authors deduce the weight of the constituent molecules of gases in the following manner: if every molecule of a gas occupies two atomic volumes, to obtain the molecular weight it is sufficient to multiply the density of the gas by two. The standard of comparison is the density of hydrogen, which, compared with that of the air (ordinary standard for other purposes) is 14·44 times smaller.

Such reasoning as this of Avogadro is a circle of puzzles; while pretending to give a propositive conclusion, it simply arrives at a verbal explanation, doing nothing more than to affirm in the consequents the same idea put forth in the antecedents, in different words but without teaching anything new. Nevertheless chemists believe that the hypothesis of Avogadro is a basis sufficient to determine the molecular constitution of simple bodies, and especially that of gases either simple or compound. Accordingly, they have decided that bodies, including the simple ones, are formed of molecules which are distributed with perfect uniformity in the gaseous state and at immense distances from one another, and that such distances are equal in all gases and vapours. Chemists also admit that the space occupied by every molecule, whether the body is simple or compound, is equal to two atomic volumes of hydrogen, but that while the molecules of some bodies are monoatomic, those of others are polyatomic, atomic aggroupations more or less complex so resulting. Thus, for instance, the molecules of the simple, more permanent or perfect gases, hydrogen, oxygen, and nitrogen, are considered as diatomic, that is, formed of two atoms exactly equal.

It is true that the densities and atomic weights are equal in hydrogen, oxygen, nitrogen, chlorine, bromine, and iodine; but the density of the vapour of mercury is half of its atomic weight, the densities of phosphorus and arsenic are double that of their corresponding atomic weights, and the density of sulphur is three times greater. But it being impossible to divide atoms, chemists have supposed that a molecule of mercury is composed of a whole atom, and that then the molecule of hydrogen, for instance, should have two atoms and so on. From this arises their arbitrary distinction of bodies into monoatomic, diatomic, triatomic, tetratomic and hexatomic. These expressions must not be confounded in this sense with the same expressions when they serve to qualify what is called atomic quantivalence, that is, their value of combination, or better still their relation among the bodies as they take the place of one another in chemical metamorphoses. From all this we clearly infer that the intimate constitution of gaseous bodies is not the same for all of them, and therefore that neither the number of particles nor the spaces between them are equal in all the gases and vapours of simple bodies. Besides, they are not equivalent in their chemical molecules, as has been demonstrated by the discovery of polybasic acids.

We have seen that the present notion of the constitution of bodies is derived from atomic weights, these being determined by the ponderable relations of bodies in their combinations or chemical metamorphoses. But if the volumes of atoms are determined by dividing the atomic weights by the densities (weights in the unity of volume), this quotient is not really the volume of atoms, but rather that of atomic parcels which may be occupied by atoms only in a very small extension in relation to the interatomic space occupied by progene. The space of such a unity of volume then is far from being occupied by ponderable matter; it contains a considerable proportion of imponderable matter, especially when the gases are not under great pressure.

The assertion that equal volumes of all gases contain an equal number of molecules is worthless. It is probably true that the vapour of mercury is the gaseous body which in greatest extension has only an atom for nucleus, but this does not mean that mercury is monoatomic and other gases polyatomic. Supposing that the atoms of all ponderable substances have the same degree of condensation, as is inferred from the fact of the falling of all bodies with the same velocity in a tube from which the air has been exhausted, the difference among atoms must be in geometrical proportions and in nothing else; with this we have sufficient to establish chemical differences among bodies without the necessity of admitting an impossible elective force in various degrees—affinity. The inequality in the volume and form of atoms, gives us not only an explanation of the different atomic weights and of specific heat, but also of the inverse proportion of these for every simple body, so that the product of these ratios is about equal for all bodies, 6·4. Accordingly, there is no reason for the atomic classification of bodies, because if this were true it would oblige us to presuppose that chemical differences could result from different degrees of condensation of the minimum particles, which, as we have proved, is contrary to fact. Therefore, the hypothesis of Avogadro is an erroneous interpretation of the empirical laws of gases; it does not explain them, and it does not account for the fact of an almost equal force of dilatation of all bodies in a gaseous state; on the contrary, such a hypothesis increases the confusion which has been already caused by the kinetic theory. The chemical molecule, and not the true atom, is the smallest portion to which the relations of weight and volume of the combinations make reference; but such a molecule as that of the chemists should be formed of an indefinite number of separate atoms, though this number must be inversely proportional to the mass or quantity of matter of every atom, on the supposition that the conditions in which the bodies in reaction are found, are the same. There is reason to deduce from chemical laws that atomic masses keep simple volumetric relations among themselves, as the numbers 1, 2, 3, 4, 6; but this does not imply that the chemical molecule whose position in such a scale is six is formed by an atom in determined volume, and that that molecule whose position is one should need six atoms. We do not know any more, we repeat, than the relation, and we can only take the abstract numbers to represent such a proportion without thereby fixing any knowledge of the real atomic constitution of bodies. Therefore, the numbers 1, 2, 3, 4, 6, which correspond to the denominations monoatomic, diatomic, etc., denote only a relation of volume among chemical elements, and not a determined number of atoms.

§ 38. KINETIC HYPOTHESIS OF GASES.

We will now see how the dynamic condition of gases is interpreted by the so-called kinetic hypothesis, which is the current scientific opinion of the day, though it is altogether an impossibility. We have already said that the kinetic hypothesis is inadmissible, whatever may be the state of matter, but the kinetic hypothesis of gases has taken such a leading place, in spite of its worthlessness, that we must occupy ourselves with it in particular.[1] The results of some calculation on the phenomena of nature have apparently confirmed such an interpretation of modern atomism; thus, for instance, the specific heat of gases when their temperature is increased under conditions which permit their expansion in such a manner, that the pressure to which they are submitted always remains the same, is a little greater than when the temperature is increased, and they are at the same time constantly reduced to the same capacity, in which case the expansive pressure of gases increases. Clausius has determined the theoretic relation of specific heat in these two conditions as 1 : 1·67. But though this relation is constantly exact for mercury, it is not exact for permanent gases, in which the relation is only as 1 : 1·40. Most authors explain this by saying that the difference of 0·27 between these two quantities consists in this, that the permanent gases, being diatomic, employ some work in changing the intermolecular disposition of the two atoms in relation with the temperature, while in the mercury, which they suppose monoatomic, the gaseous molecules do not employ any other energy than that of progressive movement in the case of free dilatation. In this we clearly see that modern physicists have used a play on numbers as frequently as a play on words to maintain false ideas, for such a difference—0·27—can only depend on volumetric (or geometric) differences among atoms.

---

[1] For elucidation on this point, see "Theory of Physics," II., Heat.

We can well conceive, after the notion we gave of atoms and progene, that when gas expands freely in such a manner that the pressure is constantly the same, progene has to lose in velocity as it increases in the amplitude of its oscillations, and as an effect of this the molecules will be separated, some progenic movement being then transferred into molecular, which is spent in the work necessary to control the force of gravity in the particles or molecules. But when the gas is confined in such a manner that it cannot expand, the work of molecular separation is not produced while t is heating, and then the movement of progene increases only in velocity, so that the difference of work between the two cases must be greater when there is a greater quantity of ponderable matter in the gaseous parcels, this denomination being given to a determined volume which is equal for all gases.

Most physicists, accepting the erroneous idea of equality of intermolecular spaces in gases, think they can explain by the kinetic hypothesis the following empirical laws: (1) quality of expansion of gases by heat; (2) equality in the reduction of volume by pressure; and (3) simple proportions of volume in their combinations. But these three facts are the result of proportional quantities of ponderable and imponderable matter existing in all gases. According to the kinetic hypothesis of gases, their constituent particles or atoms vibrate freely in perpetual movement; this being preserved, they say, by virtue of an absolutely perfect elasticity, which they suppose to be an essential property inherent in all kinds of molecules. But the idea of endowing gaseous particles with the liberty and independence necessary to move incessantly in all directions is either forgetfulness or ignorance of the relativity which exists among all parts and particles of nature. Whence comes such movement without analogy with any experienced fact and in contradiction to the principle of conservatism and the law of inertia? It seems to be an idea erroneously suggested by Astronomy, with the additional aggravating circumstance that the supposed particles, in their movements to and fro, should collide among themselves. Then they try to explain the continuation of energy by making another gratuitous supposition, that of endowing gaseous particles with the necessary elasticity to compensate the loss of energy which should be produced by their collisions with one another. We must never forget the action of gravity, as it is an illusion to believe that gaseous particles could be in absolute liberty during the time that elapses between one collision and another, in order that the abstract and illusory conception of an incessant, uniform, and rectilineal movement should be perfectly realized.

So we see the kinetic theory sets gravitation aside and supposes the gaseous particles to be endowed with perfect elasticity; it therefore is a hypothesis without any validity whatever; it is thus judged and found wanting by its own enunciation as it is contradictory to the correlation of energy between the antecedents and consequents of phenomena.

In addition to this the so-called elasticity of gases is an equivocal phrase, whose signification has been improperly ascertained by authors, as it consists in what is also called their expansibility, which is recognized by the centripetal pressure determined by the gases on the walls of the vessel containing them, and whose force is directly proportional to temperature and inversely proportional to the volume occupied by the same quantity of gas. This phenomenon is very different from that called elasticity in solid bodies, which consists in their condition not to augment, but to occupy a portion of space whose volume and forms are determined; this elasticity is recognized by the reaction against any force or action producing a modification in the volume or in the form of solid bodies, observing the fact that such force or reaction is always weaker than the action of the deforming force. We persist in saying t this elasticity of solids is not like that of fluids ich is nothing more than the reaction against reduc-n of their volume. In any way elasticity as a roperty inherent in particles of matter is as enigmatic s if it were applied to matter in general ; it is a word hich represents a fact, but which gives no explanation f it, and it is one of the many relics of occult qualities elieved in by the ancients.

§ 39. DIFFERENCES AMONG THE PHYSICAL STATES.

According to the hypothesis held by most authors ponderable particles (atoms and the other molecules) are supposed to be in continuous or eternal agitation, and therefore more or less separated from one another in all physical states. In order to avoid the explanation of such an enigma they content themselves by saying that we cannot see such particles and for this reason we cannot see their separation and movement. This supposition once made, they explain the differences between solid, liquid, and gaseous states in the following manner: in a solid when the molecules vibrate, etc., they can separate only very little from their initial position ; in a liquid there is not so great a restriction to the excursions of the molecules, but yet their free path is also limited to short distances ; in gases the molecules move freely and rapidly, being separated from one another by enormous distances. Physicists so accustomed to the abstract conceptions of theoretic mechanics forget the weight of the particles, and represent bodies as constructed of enigmatic molecular forces, explaining the solid state by greater attraction than repulsion among the molecules, the liquid by the equilibrium of the said forces, and the gaseous by greater repulsion than attraction. By the play of such abstract forces most authors suppose that when the molecules of a solid are impulsed beyond the limits of the vibrations which correspond to them they will easily return to their former position "according to their proper law;" that the molecules of a liquid can penetrate through all parts of the space occupied by a liquid "without being solicited by attraction to return to the place from which they started;" and finally, that the molecules of gases "carried on by their own or by ethereal repulsion" travel with a rapidity which, they say, is about twenty miles a minute in the air, moving during their course in a straight line because they are "not under the action of any other force," until they collide with one another like billiard balls. It is only then, they add, that every molecule changes its course in a new direction! By means of so extravagant a hypothesis most authors pretend to explain many facts, among them those already mentioned as the Laws of Boyle, Marriotte and Gay-Lussac. Thus also taking for a basis the existence of molecules in continuous movement vibrating in accordance with their proper law they explain gaseous pressure by the bombardment of the walls of the vessel by the molecules of the gas it contains. They think that temperature depends upon the velocity of molecular agitation, and for this reason when the density of a gas changes its pressure varies in the same proportion. (This is their explanation of the Law of Boyle.) They also explain the proportion between the density of the gases at the same pressure and temperature and the masses of their molecules, by saying that when two gases have the same pressure and temperature there are an equal number of molecules in all of them in the same volumes or in the unity of volume. (This is the hypothesis called that of Avogrado.) According to what has been said, physicists affirm that when atoms or molecules (minimum particles) after a collision follow on in their free path, they vibrate according to their proper law, whatever may otherwise be the state of the body; that this law is determined by the construction of the particle itself, being different for every species of substance, and they add that the vibration must manifest itself in relation with the intensity of the collision not only with that which they call proper or fundamental vibration, but also with all the movements possible to every particle. Finally they believe that the agitation of imponderable ether after every molecular vibration is the means whereby light and spectrum are produced, comparing the molecule to an emitter, the ether to a wire, and the eye to the receiving apparatus of such a telegraphic system.

We can clearly see that the notion of physicists about bodies in their different states is opposed to the true concept which we must form of material nature in which nothing is independent, no other forces existing than the concrete measure of movement, the manifestations of movement being engendered in the universe by the Creator acting first in the organisms to produce their vitality. In truth an atomic constitution in which there is a complete separation among the ultimate indivisible particles is only possible when bodies are in a gaseous or vaporous state. But it is a compulsory conclusion from the erroneous premise of the persistent molecular vibration that atoms must be considered completely separate in all their different states of aggregation. Such a supposition is only applicable, we repeat, to the gaseous state; in the other states the atoms must be in contiguity, forming complex particles which we have denominated *hydrocules* and *orocules*. In liquids we must suppose every two atoms in perfect contiguity, thus forming double particles, which are more or less separated from one another by oscillating progene, whose oscillatory energy balances the centripetal action of gravity, and so the atomic pairs or hydrocules are free to change their orientation on the slightest impulse. Such particles, which we call hydrocules, when grouped among themselves touching one another in complete contiguity, remaining fixed in determined orientation, form solid bodies (see Heat, in "Theory of Physics"). These may be either symmetric or asymmetric; in the first case they are called crystals, in the second amorph bodies. But when the hydrocules are united to form a solid they must leave porocules of honeycomb form between them, these determining a kind of limit to the solid particles which we call orocules.

We admit, then, three kinds of invisible particles—*molecules*—according to the state of bodies.

1. *Atoms*—completely separated—*gases*.
2. *Hydrocules*—atoms united two by two—*liquids*.
3. *Orocules*—hydrocules partially united—*solids*.

These last may be either *symmetric* or otherwise. But gas and liquid are in reality the same state, liquids resulting when gases are under molar pressure; and it may be said that without molar reclusion no liquid would remain in such a state, but pass into the gaseous one, and this may be easily proved even with the most weighty of all liquids—mercury—which will evaporate soon as the atmospheric pressure is very rarefied. nother opposite character between solids and fluids that bodies need to be in one of the fluid states gaseous or liquid) in order to experience a chemical metamorphosis. Again, fluids have the progenic space lmost free, or at least very diffuse, while solids have t divided into little cells or porocules which communicate with one another though in a limited manner. The greatest contrast, then, in physico-chemical relations is observed between fluids and solids; nevertheless, between gases and the other states of bodies there are very remarkable differences. Great order and simplicity reign in gaseous combinations, thus gases are combined in defined and very simple proportions of volume as expressed by the law of Gay-Lussac; this relation does not exist in the combinations of liquids; and the immediate combination of solids is impossible, as they must necessarily become fluid in order to be combined. Besides the volumetric and thermometric relations of gases are very exact, because, as we have already seen, the volume of gas increases and diminishes in proportion to the degree of pressure and heat; its velocity of diffusion is in inverse ratio to the square of the density; its specific heat is sensibly the same at all temperatures, and it is the same in relation to a given weight whatever may be its density and pressure; and, finally, specific heat is also the same for all gases in equal volume when they are not condensed in the moment of formation. Bodies in a liquid or solid state are wanting in such relations.

Now following an order inverse to the genesis in the changes of state, that is, supposing a body first in a solid state, it needs some heat in order to become liquid, and such heat is employed in the division of the solid particles or orocules, not into atoms separate from one another, but into liquid particles or hydrocules, and these need in the same manner more oscillatory energy of progene (heat) in order to suffer their division into atoms. The body will then have passed to the gaseous state. Hence, following the probable genesic order in the change of state in bodies, liquids result from the pairing of atomic conglomerations of gases, and solids result from the conglomeration of all these hydrocules in contiguity. This notion of the polyatomic particles in liquids and solids is a logical deduction from the work that is necessary for the change of state and change of temperature of liquids and solids. But as the complete knowledge of changes of state belongs to molecular physics, we refer this question to "Theory of Physics," where we have fully explained our assertions.

§ 40. SLIGHT IDEA OF SYMMETRIC BODIES—CRYSTALS.

In order to know the constitution of solid bodies, it is very important and necessary to study their symmetric forms, because the exterior symmetry is in relation with the interior symmetry, that is, with that which results when a crystal is fractured, and from this we draw the highly probable inference that the form of crystals must also be in relation with the smallest invisible particles of solidification, that is to say, with the orocules.

When a crystal is fractured the resulting pieces are not perfectly homogeneous in all directions, but show plain surfaces, which present constant incidences among themselves and with the natural or exterior facets of the crystal, so that the portions which result when a crystal is fractured have their forms in relation with the fundamental or primitive figure. Similarity in symmetry, according to which the same kinds of crystals have constantly the same angles, though the dimensions and forms of the surfaces may be different in every crystal of the same kind, is the fundamental character of crystals. All crystals have the common condition of being polyhedrical, their angles always out-jutting; the surfaces by their intersection forming straight lines or edges, and these again intersecting form the angles of the crystal, which are called vertices.

The fact of constant correlation between the form and the diffusibility of bodies is very interesting; the crystallizing substances, that is, those which are susceptible of acquiring symmetric forms by solidification are much more diffusible than those which cannot be crystallized. The so-called amorph substances, which would be better denominated asymmetric, are scarcely or not at all diffusible, that is to say, they are not susceptible of mixing among themselves when they are left quietly superposed, or when a solid is put in contact with water, or else when different solutions are separated by very porous membranes. Symmetric bodies (crystalloids) are also very diffusible among those which cannot be crystallized (asymmetric or colloid), and their diffusion is generally as rapid as in pure water. Crystalloid bodies in a gaseous state (probably on account of the form of their atoms) are more susceptible of diffusion, and pass with great facility even through impenetrable layers or membranes to liquids, and they can pass, not only through very porous laminas, but also through metallic ones when these are submitted to a high temperature, that is to say, when they are dilated by heat. These facts confirm our theory of the differences among the particles in the intimate constitution of bodies in their physical state, and so confirms the following affirmations which are contrary to the opinions held by most authors: neither symmetric nor asymmetric solids are in a free molecular state; nor are liquids constituted of atoms separated from one another but of atoms grouped in separate pairs. In solids all the atoms are in immediate contact, but not in their whole surface, they leave among themselves many spaces like invisible cells—vacuums—more or less small in every substance according to the temperature; these are what we have denominated porocules, and which must necessarily exist also in crystals. The particles into which a solid is partially divided by such diminutive cells we call orocules. The porocules of solid bodies, then, are all cellular, not completely closed, but forming a kind of open little cell, which in crystals, at least, must be of polyhedric regular form in correlation with their visible characters.

The law of symmetry, which shows us the regular proportions among many inorganic bodies, is an additional proof of the beautiful constitution of the universe even in its smallest details.

Two peculiar conditions of crystals—allotropism and isomorphism—are worthy of mention.

Allotropism is the peculiar circumstance common to different particular forms or states of the same class of matter which result from the various modes of grouping invisible particles. When such particles are dissolved, changing their allotropic state, either an absorption or an elimination of heat is produced, as in the case of a chemical reaction and the changes of physical states.

Isomorphism consists in analogies of configuration between bodies chemically different, observing that there is great connection between the forms of bodies and the forms of their combinations, so much so that Berzelius adopted as a principle, that atomic weights of simple bodies are such that similar or isomorphic combinations ought to receive analogous forms. This is one fact in favour of the correlation between crystalline forms, and the characters of the constituent invisible particles of bodies.

§ 41. CHEMICAL STATES.

Dynamically considered, the process of chemical metamorphosis is no more than the continuation of the process of changes of bodies in their physical state. This is not the right place to study the production of such phenomena, which will only be mentioned in order to establish the culminant similarities and differences in the constitution of bodies according as they are simple or compound. Though calculation in reality does not find any limit to the divisibility of matter, we know that practically there is some relative limit of division never passed by the experimental actions of chemical and physical changes of state; such particles are the atoms which are supposed to be homogeneous in themselves, among themselves, and with the whole of the body in those substances which form the chemical simple species, called simple bodies, and in which atom and molecule are synonymous. Other bodies have in themselves the appearance of being homogeneous in their optical character; the most diminutive particles are then similar among themselves, but they are not similar in themselves, because by the action of heat, for instance, a compound being either alone or mixed with other bodies, may be divided or decomposed. In such cases, it is said that the elements were chemically combined; the smaller particles in the physical division of such bodies which are not decomposed in their elements are called heterogeneous molecules. Accordingly, bodies are chemically divided into simple and compound, the last comprehending binary, ternary, and quaternary combinations. The terms *organic* and *inorganic* are somewhat equivocal in science, as chemists and naturalists use them in a different sense, chemists including as *organic* matter the definite *compounds of carbon*, resulting from the molar analysis of living structures, while many naturalists, with better criterion, call *organic* bodies which are either living or dead; those in the last case, however, still preserving the structural character which the living body presented to our ocular observation. We have adopted the words organic and inorganic in this last signification.

Binary compounds. The most important and essentially binary body in the world is water, which represents half of the weight of the earth at least, and serves either as a vehicle of dissolution, or as a constituent part of more complex combinations. The other binary compounds are not important in this work of generalizations.

Ternary compounds may be subdivided into compounds with carbon (hydrocarbons) and without carbon; the former are usually elaborated by living matter; the latter are salts very easy of formation in the laboratory as phosphates and chlorides of soda, of potash, etc.

The ternary compounds of carbon are alcohols, sugars (glucose and saccharine), and greasy and soapy substances.

Quaternary compounds. Among these are albuminoid substances, which are the principal constituents of living matter. All the chemical principles of this group are nitrogenized, and contain also carbon, hydrogen, and oxygen, and the principal albuminoids contain sulphur besides, one kind only—coloured proteins—containing iron. Nitrogenized substances or nitro-carbons may be classified into crystalloid and colloid. The last almost corresponds to what are called albuminoids, in which only two crystalloid substances are included—hemoglobine and viteline. There are many species of nitro-carbons, among which the most important are (1) crystalloids, acids, as uric acid, amides, as urea, and colouring matter, as hemoglobine; (2) colloids, as albumen, fibrine, casein, etc.

These are the chemical states (distinct from the physical ones), in which even in the same body there are great differences in intermolecular distances, and in the state of aggregation in their particles.

Almost all chemists recognize to-day the analogy of all chemical combinations; the organic compounds so-called by authors (but better named immediate principles of organism), do not essentially differ from those called inorganic compounds. Thus, the supposed simple radicals are assimilated according to Proust's theory to the compounds denominated organic radicals; the former differ from the latter only in their greater stability so much that they have resisted up to this time all efforts to analyze them and to produce them in the laboratory. Here it is sufficient to remark that chemical operations cannot be logically divided into organic and inorganic, because there is no phenomenal difference between the reactions qualified by such opposite denominations, and finally that all chemical metamorphoses are mechanic results, as is heat or any other physical phenomenon. Therefore, there is no doubt that the most complete harmony exists among all chemical reactions, and that there is no absolute difference between organic and inorganic metamorphoses; and from this arises the present true tendency to unify these two unjustly separated branches of Chemistry.

It is believed that the atomic weights of all simple bodies are a multiple of one particular body. This body, which must be the primordial chemical type (protile? $=x$) is not hydrogen, as was formerly believed, from the fact that the relations of the other bodies with it as a unity are expressed almost always in entire numbers, but there are some exceptions to that rule, and this is a sufficient reason for not considering hydrogen as the type. If all simple bodies belong to a natural family forming by their relative value an arithmetical progression, we again infer that even bodies considered as simple in Chemistry are aggregates of one kind of matter alone, though with quantitative differences. By irreflexive experience, at first sight, we observe indefinite varieties of similar bodies; nevertheless, after all are analyzed, they are relatively reduced to a very limited number of chemical elements, about seventy in all. In every one of these their minimum particles are similar among themselves, and with the totality of the mass, so that the bodies constituted by only one of those elemental species of matter are completely homogeneous in and among themselves. If the molecules of a simple body (homogeneous molecules) come in contact with others in such a manner as to form complex particles (heterogeneous molecules), every one constituted by molecules of the two kinds, the conflict of a chemical reaction called combination is produced. On the other hand, the resulting compound submitted to the actions of other bodies may be disassociated into its elements, so producing the contrary reaction called decomposition.

Most chemists admit that such metamorphoses among heterogeneous bodies are produced by a special force, the exclusive resource of Chemistry—such is the so-called *affinity;* they add that such a force is different from that which produces the union of homogeneous molecules, and they admit still another for their separation or repulsion. But, in our day, some distinguished chemists are studying the great connection between heat (a mode of movement acting as a repulsive force) and affinity and cohesion (which act with the appearance of attractive forces). We shall see in Chap. VII. that these attractive actions are perfectly explained by the preponderance of the centripetal pressure of progene—*gravity* upon the centrifugal—*thermity*. If the direct combination of bodies emits heat, the same heat must be newly absorbed in the moment of their decomposition; and it is a very important and fundamental fact of modern thermo-chemistry that the thermic and chemical actions are always in such a correlation.

Most chemists have not contented themselves with endowing atoms with the inherent force they call affinity, they have supposed them besides as possessing a property in themselves as a consequence of their own constitution which they call quantivalence or valence alone. This is the relation in the substitution of the bodies in their chemical combinations. The particular criticism of such ideas belongs wholly to the Theory of Chemistry given in "Theory of Physics."

§ 42. SPECTRAL ANALYSIS, APPLIED TO THE STUDY OF THE CONSTITUTION OF BODIES.

The new spectral analyses have revealed great knowledge of the constitution of bodies, not only in the gaseous, but in the other states. All bodies may become luminous when they are submitted to the action of great heat, but luminous radiations vary according to the constitution of bodies, with specific characters for every one. The particles which produce light and the spectrum can be considered as the characteristic molecules of the chemical species, because the spectral images of compound bodies are characteristic of them, that is to say, of their complex particles (which we call chemical parcels), and not of the component elements—atoms. It is always necessary to take care not to decompose them by the temperature needed for the experiment, because if they are decomposed by the action of the flame, it is then observed that all the compound bodies of the same metal generally produce the same spectrum consisting in the rays emitted by the common constituent element.

Although the luminous radiations of simple bodies produced under the same circumstances are different and characteristic for every element, giving in every case a determined spectrum, we must observe that the spectrum varies according to the temperature and the state of the body when submitted to the experiment. The spectrum of all bodies, elemental and compound, may vary, as we have now said, with the different degrees of temperature; thus, for instance, sulphur heated to a dark red produces a continuous spectrum obtained by absorption, but if it is heated to a white red, we obtain the linear or discontinuous spectrum. Spectrum analyses show us clearly that when a simple solid is heated its constituent particles are more separated, and this statement is applicable to all bodies. The spectrum varies also and principally according to the physical state of bodies. When the first studies in spectrum analysis were made, all physicists only took into account the extreme cases of spectrum, and the general proposition was enunciated that "solids and liquids give a continuous spectrum, while gases and vapours give a linear one." But the spectroscope has shown us besides intermediate images between the two extreme cases; such intermediate spectrums are fringed, or at least there are continuous but partial absorptions which can be resolved into such a fringed spectrum.

All spectroscopic facts show us the correlation between the molecular changes in the constitution of a body and the spectral variations. This correlation is erroneously interpreted by the kinetic hypothesis, maintaining that the only molecular difference in bodies, when they change their physical state, is the greater or less extension of intermolecular space without any variation in the particles; so that, according to the kinetic hypothesis, these particles are the same for solids and liquids as for gases. If (according to this hypothesis) the particles were equal in all the states, a difference in movement only existing, it is clear that all authors should deduce the false consequence that under different conditions of intermolecular space the same particle, according to the different states of its supposed vibrations, would give us such spectroscopic differences as those between continuous and linear spectrum, which is contrary to fact. The particles—atoms—which constitute a gas are disposed with great order, and are separated from one another by the oscillatory movement of interstitial imponderable matter (progene) as is seen by the spectrum analysis; while in the other states the spectrum reveals great atomic union, especially in solids, and greater still if they are not subjected to a very high temperature.

The number of characteristic lines in a spectrum is proportional to the chemical equivalents; and the luminous absorption (in the spectrum of absorption of course) is proportional to molecular complexity. From these facts arises the supposition that the unity of atomic comparison (*i.e.* protile) will be determined when we find the body whose spectrum is characterized by only one line; and precisely such a kind of spectrum has been recognized among the sun's constituents, and has been called helium. Is this, then, the long-sought-for protile? Reason, always, though in different ways, is obliged to establish the inductive unity in nature in order to derive physiological relations and theories.

Spectroscopic facts are not in connection with molecular motion, but with the manner of molecular aggregation. The continuous spectrum will result when the atoms are grouped in greater though incomplete contiguity, in opposition to the line-spectrum which supposes the atoms widely disseminated in the bodies—gases and vapours—which produce it; and in addition to this we observe that such a spectrum results only when a very high electric tension is employed for the incandescence of gaseous bodies, and that even at the highest temperature produced by combustion the vapour of some elements give us a continuous spectrum in the most refrangible extreme. When the density of gases is increased, and their temperature diminished, their spectrum becomes more and more complicated; while on the contrary it is possible with small pressure and high temperature to obtain from gases and vapours a spectrum consisting of one line alone, different in every one of the gaseous bodies, in which case the atoms are much more separate than in the other. But bodies in a solid or liquid state always, or almost always, produce a continuous spectrum, whatever may be their degree of incandescence; this denotes the contiguity of atoms in these bodies, forming greater and more proximate particles.

Our explanation of spectrum is as follows: When a body is heated to incandescence the imponderable material or progene acquires more amplitude in its oscillatory movements, until it cannot be contained within the porocules of the body; it is then partly forced outside of the body and so establishes the radiating movement of progene—light and radiating heat. Hence corporeal particles are only reflectors, either polyatomic as orocules and hydrocules, or monoatomic as the particles of gases. These last, from their smallness and great dispersion, may be discontinuous reflectors, for this reason producing discontinuity in refraction through the prism; when the discontinuity is very great, we see the line-spectrum which perhaps is produced by the reflection of every separate atom. The particles of liquids and solids are always continuous reflectors, this being the effect of their greater magnitude and proximity. Finally, the fringed spectrum gives us reason to suppose that it is produced by orocules, whose atoms, though in close contiguity, leave large porocular spaces as the effect of the expansion produced by very high temperature or by electric tension.

§ 43. RECAPITULATION OF THE CONSTITUTION OF BODIES, ESPECIALLY OF GASES.

The true atomic and molecular constitution of bodies exists only in their gaseous state, and for this reason the study of the constitution of gases is most interesting. To think rightly on the constitution of gases, we have been obliged first to fix the facts establishing the generalizations called laws, and afterwards to select the theoretical ideas that have been considered as evident or very probable in order to infer a logical interpretation of such empirical laws. These are three: (1) All gases (simple and compound) change volume equally when they are subjected to the same variations of temperature and pressure; (2) all gases have the same fixed relation (with slight differences) between their capacity under a constant pressure and their capacity under a constant volume; (3) gases are combined in very simple relations (first digits, 1, 2, 3, or the most simple fractions $\frac{1}{2}$, $\frac{1}{3}$, $\frac{2}{3}$), and the resultant of a combination of gases is also in a simple relation with the sum of the components.

For the interpretation of these facts we must remember the true concept of matter and that of the constitution of bodies in general, without forgetting principally the influence of the universal means—imponderable matter or progene. We must not admit in r reasonings the intervention of imaginary molecular rces, nor of other actions at a distance.

The relations of volumes before expressed show us hat gaseous bodies have their particles distributed with egularity, and that they can be considerably separated rom one another in comparison with their volume. Therefore the energy of progene among the minimum particles must be equal throughout when the gas does not experience any change either of temperature or pressure, for progene being free, any change of temperature will be propagated through it to re-establish a uniform equilibrium. Thus, for instance, when the capacity of the vessel which contains a gas is reduced, the pressure will increase first on the particles nearer the walls of the vessel, and will be at once transmitted by means of progene as far as the most distant ones; so the volume of the gas will be reduced with sensible equality in all its parts. When a gas is heated, progenic energy is propagated to it; the increase of energy may be only in the velocity of its oscillations, or in its amplitude; the former occurs when a gas is completely enclosed in a constant volume, and the latter when the pressure limiting the gas is constantly the same—that is, when the gas can freely expand according as it is heated. From this it results that every gas must have its particles — atoms — more or less separated in relation with the temperature and the pressure, the intervals being equal in all parts of the same gas if they are submitted to the same conditions of temperature and pressure; but the intervals must be different according to the volume of the minimum particles of every gas, because the greater the atomic matter the greater must also be the quantity of progene, nearly in the relation of 1 : 2. This is inferred from the 46 per cent. loss of force in movement, that is to say, the volume of interatomic progene of a gas necessary to equilibrate atomic gravitation must be almost twice as much—1·92—as that of atoms.

This idea is contrary to that enunciated in the hypothesis of Avogadro, which is that equal volumes of gases or vapour contain the same number of molecules; but we must remark that Avogadro called molecule a portion of any gas enclosed in a volume always the same for all gases. We see that this, rightly interpreted, is merely a tautological explanation of the laws of Boyle and Mariotte, the same idea defined with synonymous words—that is, that all gases occupy the same volume under the same pressure and temperature. This tells us nothing of the proportion of ponderable and imponderable matter in the constitution of bodies; still less does it take into account the porocules which contain the interstitial progene, and that form part of the volume called by chemists atomic and molecular.

The adoption of atomic weights is also a conclusion contrary to the said hypothesis, for there is no exact proportion between atomic weights and the density of vapours and gaseous bodies, as is clearly seen with mercury, phosphorus, arsenic, and sulphur.

Spectral analysis has given us great knowledge, and will give us still more, on the intimate constitution of bodies—that is, on the arrangement of the particles in the different states, distinguishing the molecules from the hydrocules and orocules, and thus also differentiating the ponderable particles from the imponderable ether or progene existing among the said particles.

In order to interpret correctly spectroscopic facts, it is necessary to bear in mind that corporeal particles, being ponderable, must suffer a continual loss of living force, so that any of their movements must be arrested soon after the action of impulsive force has ceased; and this affirmation is also applicable to vibratory movements, however minute or invisible.

Therefore the interpretation of light and spectrum according to the kinetic hypothesis of molecular vibrations, is wholly erroneous. In our real or practical reflections we can subtract imponderable matter alone from the action of gravity, as this is the only substance capable of keeping in movement when ponderable matter is not opposed to it.

Great differences exist in the intimate constitution of gases, liquids, and solids. In liquids the molecules are not completely isolated from one another—they are grouped in series of twos, so forming hydrocules; and in solids the hydrocules are grouped in indefinite numbers, forming series of cells called orocules, which, when arranged with harmony, symmetry, or regular proportions, constitute crystalloid bodies.

CHAPTER VI.

CONCEPT OF ORGANIC BODIES: SOLIDS AND FLUIDS TOGETHER, ESPECIALLY IN THE FORMATION OF THE HIGHLY COMPLEX STRUCTURES CALLED LIVING MATTER.

§ 44. General idea of organic structures (chemical and morphologic characters)—§ 45. General idea of organic functions—§ 46. General idea of organic generation (cellular multiplication)—§ 47. Brief idea of nutrition in particular—§ 48. Classification of vital functions—§ 49. Cause of vitality—§ 50. Recapitulation of the concept of living matter.

§ 44. GENERAL IDEA OF ORGANIC STRUCTURES. (CHEMICAL AND MORPHOLOGICAL CHARACTERS).

The substances for the formation or elaboration of organic structures are of two kinds—ponderable and imponderable; the earth and atmosphere supply ponderable substances, and the rays of light supply the imponderable metafluid or progene.

From the chemical analysis of inorganic bodies (the ovule and its derived organic elements) four simple elements principally result—carbon, oxygen, hydrogen, and nitrogen—which combined with very small proportions of other elements (sulphur, phosphorus, chlorine, sodium, potassium, calcium, and iron) form chemical species of definite composition called immediate principles. These may be separated and distinguished from one another by molar division without the necessity of subjecting the whole living body to chemical analysis.

Particular attention must be called to the fact that all the immediate principles of organism are compounds of carbon—a fixed solid, perhaps the most perfect in its solidity—and of the gases oxygen, hydrogen, and nitrogen, which are the only ones that can be called perfect in their gaseous state. This condition, being so general in organic constitution, must be very important, although its object is as yet unknown to us.

There is no organic structure which may not be divided simply by molar action into different chemical species, most of which are ternary and quaternary compounds of carbon and are ordinarily called immediate principles. These are considered by most authors as "organic matter," but we have avoided using this phrase with such a meaning on account of the vague and erroneous concepts that have been attributed to it; to-day there is an imperious necessity of unifying concrete chemistry instead of dividing it into inorganic and organic. We have reserved the word organic for the structure of living matter, or of dead organism while the body still preserves the same somatic appearance as it did in life, that is, for the complex material which can be elaborated only by organism—protoplasm, cellules, and their derived anatomic elements.

Living matter is chemically constituted by the union of simple and compound bodies which may be classified into four groups—monary, binary, ternary, and quaternary; and although some have more than the four elements in combination, they may also be comprehended as quaternary. A few gases, as oxygen, nitrogen, and hydrogen, are found in a simple state of dissolution in the liquids of organism.

The union of such chemical species in organism is not a fixed or definite combination but an indefinite, variable mixture forming highly complex structures whose anatomical synthesis is of more importance to us than their chemical one. Anatomical elements may be considered either as isolated or united, the last forming the organic tissues and the constituent liquids of living bodies. The abstract conception of the ultimate living elements is called *cellule*, and the smallest microscopic parts resulting from the anatomical division of the most complex organism are cellules or derived from cellules. Thus, the human germ or ovule is a typical cellule of the most complicated constitution, composed of protoplasm contained in a closed, round, minute vesicle or bag formed by a membrane of uniform appearance—cell-wall; enclosed in the protoplasm is a round or oval nucleus standing either in the centre or near the cell-wall. The protoplasm constitutes the total contents of the cellule with the exception of the nucleus; its characteristic marks vary considerably in every kind of element, but it is always composed of a nitrogenized substance which is of a very complicated structure though at first sight it appears to be a uniform viteline mass. The protoplasm and nucleus have been objects of microscopic details which are, however, of no great consequence, because no conclusion of functional interest is drawn from them; we need only know that the nucleus, like the protoplasm, when very young, has no membrane around it, though frequently one appears later on. We must also remark that some cellules lack a nucleus, while others, on the contrary, have many. Of all the parts of organic cells the constant and primary one is the protoplasm ; the vesicular bag called membrane or cell-wall is often wanting, and is considered as a simple condensation of the most peripheric part of the protoplasm. Most embryos (animal and plant) are in their first stage perfectly simple and uniform granular globules of protoplasmatic mass, but in their development, usually after a prodigious reproduction, they keep in some cases the form of cells, either free, one cell being separated from another by liquids, or grouped together, acquiring a solid consistency, while in other cases anatomic elements are so changed in form that they can only be known as derived elements by observing their successive transformations.

The organisms developed in some degree have not only corpuscular constituents but also formless materials called extra-cellular or inter-cellular. These amorph substances are liquid and solid, and form an atmosphere for all the organic corpuscles. The function of such substances is not yet well known ; they seem to act as an internal medium in which there are no changes other than those derived from the material circulation of the anatomic elements. In solid intercellular substances a great distinction is made between those of uniform appearance, and those formed by the juxtaposition of heterogeneous parts ; these last may be classed into four kinds in relation with their chemical constitution—gelatinous, elastic, cartilaginous, and calcareous. In addition to these four solid intercellular substances, there is one semi-liquid between the embryonic cells of connective tissues, and another liquid which usually constitutes the extra-cellular substance of the circulating liquids of organism (blood, lymph, and chyle), and which by some histologists is also supposed to be in the interstices of solid tissues where it is called interstitial juice or blastema. We need not pay any attention to the characters of these different parts, because they are not general objects, but only special to very well developed beings.

The word "organism" signifies the existence of parts dissimilar in structural character acting in harmony and definite succession, with multiplication of living beings; and the phrase "organic matter" signifies, not only organisms, but also dead bodies which yet preserve the morphological characters which they had during life, though having already lost living energy. So organic matter may be either living or dead, and we exclude from this the material resulting from its division by decomposition which has already lost the structural appearance of living bodies and corpuscles. It is nevertheless impossible to determine any graphic character as specific to all organic matter, though this has been attempted in most works on Natural History, in which a pretence is also made of establishing many phenomenal differences between living bodies or organisms and non-living bodies; we here anticipate the fact that there is in truth only one characteristic difference, and that is the reproduction or multiplication which compensates the constant loss of living force in the mechanism of the world.

Most organisms, in their origin or ovular state, are minute globules essentially formed, as before stated, of a highly complex organized substance called protoplasm, which is usually enveloped in a membrane called cellular, and ordinarily contains a condensed nucleus. There are many living bodies whose constant state is the globular, called also cellular: such are many microscopic unicellular organisms; but most living bodies (those which are seen by the naked eye) grow by a cellular multiplication, the numerous cellules being developed and arranged in marvellous order, forming a multicellular organism. In some of these the cellules lose their primitive globular form and take fibrous, tubular, and membraneous forms; others form a substance of uniform appearance separating the cellules more or less from one another, being called for this reason intercellular substance, which, as we have already said, may be either solid or liquid, in the first case forming tissues, and in the second the constituent liquids of organism.

The unicellular organisms, and even many which are multicellular, are in all their parts in direct interaction with the inorganic world, so that the material change between the cells and the cosmic medium is immediate; but most living beings are formed in such a manner that all the elements cannot be directly in mutual action with the external world, and many of them interact only with some other constituents which may be called their internal medium. The former elements are those which constitute the prosenchyma (tegumentary and glandular epithelium), and the latter are those which constitute the parenchyma. In the latter are the circulating elements (as blood, lymph), which establish their molecular interchange directly with the superficial elements, being besides the intermediary elements for the molecular changes of the fixed elements of the parenchyma among themselves and with those of the prosenchyma. The stationary (non-circulating) elements of the parenchyma are connective and cardinal, the last comprehending those which are nervous and muscular.

We have enumerated five species of elements, namely, epithelial, circulating, connective, muscular, and nervous; every one of these characterizes a class of elemental organs, and all are in perfect correlation with as many forms of functional activity, which are: (1) the epithelial organs (including the glandular) are especially engaged in the work of introducing material into, and eliminating it from the living economy; (2) the circulating organs engaged in the molar interchange among the separate parts of the economy; (3) the connective organs which, besides their conjunctive use, are the most fertile for the regeneration of most of the other elements; (4) the muscular organs which are engaged in the molar work of contraction; and (5) the nervous organs which are the progenic transmittors for the sensations, and for the order of the movements the body must execute.

§ 45. GENERAL IDEA OF ORGANIC FUNCTIONS.

The interactions of living bodies (as of any object whatever) are of two kinds, *intrinsic* and *extrinsic;* in the former the antecedent and consequent of the action are within the individual, they being then called *intransitive;* while in the latter one of the terms is within the individuality, and the other is without in the cosmic medium, such interactions being called *transitive.* The transference of one kind into another is simply by propagation. Intrinsic as well as extrinsic interactions may be either imponderable (progenic), or ponderable (molar and molecular); and in the progenic we make the distinction of phenomenal and potential according as the changes are manifested or latent. We always employ the term potential, not as the opposite of actual or active, but according to the capacity of our perception or consciousness of physiological propagation; in like manner the term intransitive is also relative in reference to a part of the system which we can imagine separate from the rest only by mental abstraction.

We must not forget that when progenic activity is directly propagated through interstitial progene, the changes we have called progenic result, which generally produce in bodies expansive actions apparently repulsive (as thermic, sonorous, and luminous propagations), and when, on the contrary, progenic action is directly propagated to the ponderable matter of another body, and when interstellar progene collides with bodies, a contracting action results; such are the effects of molecular and molar changes which appear to be produced by attraction, gravitation (in its different forms as cohesion and affinity), and magnetism. Thus, then, progenic propagations, through bodies, produce the effect of dispersion among the molecules, while the effect of ponderable transference of progene is compressive. If these different classes of changes or energies exist in cosmos in general, and in organism in particular, forming a synthesis, any phenomenon whatever, either in cosmos or in a living being, is the result of the contrary operations of the two forms of progenic propagation now mentioned. Thus, for instance, a potential change like the progenic transmission of electricity and what physiologists call automatic and nervous action, may be a virtual result of the phenomenal movements of sound, heat, light, cohesion, affinity, gravity, magnetism, etc.

The first agent we know in the sphere of physiological actions is already a secondary one; this agent is progene in movement under its two forms, oscillatory and translatory, and these movements, when communicated to ponderable matter, produce the apparent effects of attraction and repulsion which we have called gravitating and thermic energies. This occurs in the same manner in living as in dead matter. Then, translatory movement, being implied in phenomena, having the appearance of molecular attraction, as cohesion, affinity, and gravity, necessarily supposes the current action of progene, while the oscillatory movement of progene, which causes heat, must be the immediate origin of all phenomena having the appearance of molecular repulsion. There are, besides, phenomena called magnetic, which have the appearance of molar attraction and repulsion; these must necessarily be determined by translatory movement of progene, and must therefore be considered as effects of progenic potence in all nature, in the inorganic as well as in the organic world.

The physiological synthesis of organism cannot have a perfectly developed theory, so long as it cannot mathematically explain the changes of propagation and transferences which are combined in vitality. When can this point be reached which must be the beacon of the physiologists of the future? That we cannot calculate, because a great analytical difficulty is yet to be overcome, which now only allows us to make a very defective study of physiological synthesis. The molecular movements of chemical metamorphoses and progenic movements are not yet measured either directly or with precision, as are those of the steam engine; hence arises the lack of fundamental knowledge of necessary data to experiment on the transferences of the different forms of energy in cosmos, and especially in organism. The work is as yet scarcely begun in physiological analysis, and until the knowledge of cosmos is analytically complete, we cannot take one secure step in its synthesis. Nevertheless, experience has begun to prepare the field with what is called Chemical Synthesis.

There is a material circulation in organism by which constant renovation of its constituent elements is produced, because in organized bodies there is a constant absorption and elimination of their component substances. To accomplish this many chemical reactions take place in organism, their result being the oxidation (decomposition) of the complex principles constantly elaborated by the vegetable world, and in this manner the substances and heat needed by the vegetable kingdom for its growth are returned to the inorganic world. This material circulation in all living things is only a continuation of the generating power—the permanent and superior function of living matter; all other functions of vitality are but modes of the great original function—generation. This, then, is at bottom the first of all physiological operations; such an organizing power acts continuously in organic beings during all their development, although its effects gradually decrease from the beginning to the end. Generation presupposes the fecundation of a generating element and the conception within it. Thus, any cellule feels the impression of the medium which surrounds it, and this excitement is its fecundation which incites such morphologic element to a vital evolution in itself. The cause of this capacity is supernatural, that is, beyond what mechanism can accomplish, as in this only propagated effects are produced.

All living bodies, without exception, are subject to a limited existence, during which they undergo continuous changes which determine successive phases according to their ages; every organism is born by excision of its germinal being, develops like its originators, and ends its evolution only with death, which means lack of engendering energy, followed by decomposition into inorganic matter.

The vegetable kingdom has apparently no other manifestations of vitality than material circulation (nutrition) and reproduction; but in the animal kingdom, especially among the larger animals, the living force is well manifested in some other ways, in order to accomplish its great necessities, which are the establishment of the mutual connections of their parts among themselves and with the world, and especially for their molar movements or muscular work. These two last manifestations of vitality, innervation and contractility, have been considered peculiar to animals, and qualified by the determination of animal functions or animal life, in an attempt to differentiate them from vegetative functions or vegetable life—reproduction and nutrition. But, in fact, sensibility and contractility are also functions common to all organism, and are clearly manifested even in vegetable germs. Nevertheless, these functions are not practically worthy of special mention here, because they are only well developed in animals of most remarkable complexity.

The first and most important fact of the elaboration of immediate principles occurs chiefly in vegetables whose leaves and green parts, containing chlorophyl (green colouring matter), may appropriate the progene necessary to produce a chemical reaction between carbonic acid and water in order to form hydro-carburets and eliminate oxygen. Rays of light are also necessary for the successive reactions of organism, among which the most important is dishydratation (elimination of water from a combination). In organism there are not only reactions with absorption of heat, or endothermic reactions, but there are also exothermic reactions, in which there is elimination of heat and carbonic acid with absorption of oxygen. These last combinations occur in living matter which lacks chlorophyl (or any other colouring structures), and also in all organisms when not under the action of sunlight; they are necessary for calorific reparation in organism, and for the compensation of other losses of living force which are continually dissipated in the works of cosmic mechanism. So during the night all living bodies, whatever their colour and class, exhale the products of exothermic reactions, while during the day there is an excess of endothermic combinations, or chemical reduction in the green vegetation which contains chlorophyl. Inferior microscopic organisms also assist the vegetable kingdom in its work of organic formation, especially in the elaboration of nitrogenous principles. Chemical reaction of animal life is a kind of oxidation which ends in the destruction of organic matter, thus providing the heat and movement necessary for the play of their own mechanism and that of the world in general. The constituent substances of organism, progene included, are in this manner in constant circulation, being taken from inorganic means by the vegetable world and restored to that cosmic means by animal life.

We have said that the living elements (cells and their morphologic derivatives) are characterized by their texture, and we will now see that the function of the elements is correlative with their texture, and that in this agreement exists the culminant reason for the classification of the anatomic elements and organic systems. We must bear in mind that though every one of these organic systems is characterized by special activity, this does not mean that every change of vitality is exclusively produced by a determined elemental structure; on the contrary, all the organic changes take place in all and every one of the anatomic elements (cellules); they all accomplish the acts of nutrition; they all feel in their own way and are more or less contractile; but there is a great difference in the relative intensity of the changes of every element, and some elements are infiltrated with inorganic substances so as to become useless for all vital changes in general and for nutrition in particular. Thus, also, some elements are permanent, living as long as the whole individual, and such elements lose with age their genesic power, becoming sterile like old people and old animals. Only the very young elements are fertile, and these exist in all ages of organism, because some cellules are very frequently regenerated by multiplication and have a shorter life than the whole being. So there are fertile and sterile elements: thus all the muscular and nervous fibro-cells are sterile, while on the contrary the young layers of epithelium, and the cells of connective tissues are very fertile.

On the other hand, no element develops its activity in a great degree in all forms of vital action; according as one form increases the others decrease, and some pass to a rudimentary state, becoming almost inorganic. The elements which preserve vital activity are of two kinds: one preserves the primordial activity which is called vegetative, that is, simply the changes of circulation of matter (reproduction and nutrition); the other changes the form and the activity very much, acquiring in complete development the functions which are not developed in the vegetable kingdom (innervation and contraction). The four are common to all living matter, but the former being almost the only form of activity of the plant cell are called *vegetable systems*, while the latter, being remarkably developed in some of the animal cells, are called *animal systems*. We have already called attention to the relative signification of these terms.

In complex organisms every anatomic element (cellule) produces its material change in harmony with its organization, and manifests some peculiar form of activity which is always derived from engendering potence; but no element is independent; all are subordinate to the organic system of the individual whole; every element is complementary to all the others, so constituting a being which is also a partial system and not an independent thing; hence, one living being is in interaction with all the others which compose its external medium, and every part of a being is also in interaction with the rest which acts like an internal medium. In consequence of this, animal blood and the sap of plants are not the only internal mediums, for every cell has around it the immediate medium for its interchanges, and the distant elements serve also as internal mediums, though in a mediate or indirect manner. Nevertheless, it may be said that the circulating and nervous apparati are principally the internal medium, the one serving for molar or bodily transportation and the other for progenic transmission; both determine acts whose final aim in the individual is general to it, as they are the common and mutual intermediary parts of all the parenchyma, and form the means whereby the distant interchanges between the other internal elements and the prosenchyma are produced. This last is the external intermedium, although like the parenchyma it needs besides interchange with the internal mediums—circulating and nervous complements.

Two interstitial changes are common to both parenchyma and prosenchyma which consist in: (1) assimilating from the interstitial transudation of the circulating apparatus the necessary principle for the vital evolution of the elements, and transforming the assimilated material into its own substance; and (2) disassimilating the constituent substances by a gradual oxidation, that is, by a kind of combustion producing living force manifested as heat, muscular contraction, etc., or transferred into nervous current. Afterwards, for the elimination of the products that result from the said oxidation, they must be dissolved in the interstitial juices in order to enter the circulating system.

The changes of the prosenchyma that are said to take place exclusively in the periphery of the body and in the cavities visibly open to the outside, are not special; they are similar to those in the parenchyma; but it may be said that the external changes of the tegumentary and glandular systems are generally reduced to two kinds of operations: osmos (exosmos and endosmos) and genesis. Both are really similar to the nutritive changes that take place in the interstices: the osmos may be either gaseous or liquid, this last containing substances in solution, and it may also be endosmotic or exosmotic, the former consisting in greater absorption than elimination and the latter in the reverse. The principal genesic external changes are those of the special organs for the reproduction of individuals in which the elimination is not only of liquids but also of cellular elements. We have here mentioned four forms of external changes: (1) gaseous osmos or respiration; (2) liquid endosmos: intussusception or absorption; (3) liquid exosmos: elimination; and (4) cellular secretion, the elements of which may be either fertile or sterile, in the last case there is epithelial renovation. In addition to these there is another form of external change, that of imponderable or progenic interchange which consists principally in the absorption of light and the elimination of heat by radiation and conduction.

§ 46. GENERAL IDEA OF ORGANIC GENERATION.

All living bodies, elemental as well as complex, have a fixed determined evolution; all are at the beginning a unicellular germ of the same species, and every one of the anatomical elements of our organism must, like its totality, be engendered by parents; not one can be formed by the direct union of inorganic matter outside of an organic field: "*omne vivum ex ovo*": "*omnis cellula a cellula.*"

Genesis must be studied in the species and in the elements; the former is the individual or total reproduction (integral genesis); and the latter is the partial evolution of every one of the living constituents of an individual (elemental genesis). From this arises our distinction between integral and elemental genesis; but this being here only the subject of generalities, each part does not need separate treatment.

Genesic evolution in general has three periods: (1) *birth*, molar change consisting in the excision or multiplication of living elements; (2) *development*, which, applied to the elements alone, is a molecular change consisting in the thermochemic phenomenon of nutrition; and (3) *regeneration* or new multiplication of the developed element in order to give place to those which must substitute the dying cells. These three subjects comprehended in genesic evolution (birth by reproduction, development by nutrition and regeneration by reproduction) are identical in fact, and it would be a departure from the natural if we should treat of the study of them as altogether different functions. Development is only a continuation of genesis until the period of the decadence of life, and from that onward the only form of genesis is nutrition, which lasts until death. Nevertheless, nutrition is considered apart from genesis, and will form the special topic of the next chapter, chiefly because it is the most important function.

We must now criticize the *theories of cellular formation* which describe the modalities of elemental reproduction. There are two principal ones; the first originates in the so-called German school, at the head of which is Virchow, and the other is the French school, at the head of which is Robin. The theory held by the first school is also called cellular, and that held by the second substitutive or free cellular formation. The German school maintains that intercellular substances are always products of cellular secretion or a modification of the peripheric part of the cells, and that the substance thus produced has not the capacity of reproduction ; that the blastema (if it exists) is sterile and cannot be the field for the formation of new cells, and consequently Virchow and his followers admit only intracellular genesis ; still more, many deny the existence of blastema. According to the hypothesis of the free cellular formation the first thing that may appear in order to form some organic elements is a blastema, that is, an amorph substance in which the constituent parts of the cellules are formed by a kind of crystallization ; that is to say, Robin and his followers admit not only genesis by intraformation, but also genesis by juxtaposition. Robin says that blastemas come from the blood and are not completely homogeneous, as, he says, he has observed in them protoplasmatic granulations, and frequently cells like leucocites or white globules. In truth the juices of the parenchyma are not well known although they must undoubtedly exist, and we can only suppose that they are a compound of blood exudation and of products from the surrounding cells. But this is not sufficient reason for affirming that there are organizing substances outside of cellular life ; that the elements of new formation or granulations are formed by juxtaposition and condensation of the supposed blastemas or citoblastemas. There is great objection to such an idea, as it is well known that nutrition (genesis of cellular development) is a process of intussusception, the substances being received within or absorbed by the cells and not juxtaposed to them. In order to overcome such an objection, those who maintain the existence of blastema suppose that this is the product of pre-existent cells, and therefore that the new ones proceed from old ones, though by indirect reproduction, and that such intermediary blastema may engender cellules in two ways, first, by the spontaneous or free appearance of a nucleus around which some quantity of blastema is condensed in a less degree than in the nucleus, and, second, by the division of a free mass of blastema into globules in which nuclei are afterwards formed. This hypothesis of substitution is now upheld by very few, and even these only admit it in the following cases: (1) in the formation of the sexual elements, male and female; (2) in the formation of the first embryonic cells; (3) for the generation and regeneration of epithelium; and (4) in the greatest number of pathological neoplasms.

We see that there are two contrary opinions in regard to the formation and functions of intercellular substances. In fact, there are still some doubts as to the predominant source of such substances, whether they are principally formed by the cells as products of secretion, or by the blood, the substances of assimilation then predominating. It may be stated with great likelihood of truth that the solid intercellular substance is formed by the nearest cellules, as the exudation from the blood-vessels must be about the same in all parts, and the chemical and morphological constitution of intercellular matter differs according to the proximate anatomical elements, and it has been sometimes clearly seen that the elastic filaments are directly formed by cellular metamorphosis or by cellular prolongations. Cellulists assert that the use of intercellular substances is purely connective; that they undergo molecular change, but that this activity depends on surrounding cells, and that in any case they cannot be organizing or engendering fields. Their employment, then, is reduced to that of molar supporters for the union and separation of elements, and under molecular interchange they serve as an internal medium for the passage of matter from the blood-vessels to the cellules and *vice versâ*.

The belief in the free formation of cells in the blastema is in some manner coequal with that of the spontaneous genesis of living beings, and the maintainers of such ideas say they have presented experimental proofs in favour of their opinion ; they believe in the birth of inferior organisms in a liquid in which no such organisms previously existed, and they think that fungi, algæ, infusoria, and interstitial worms are engendered in organic detritus. It seems to be true that organized elements originate in a medium where others were not before perceived, such as in the exudation from a blister after being filtrated, or in a drop of sweet and perfectly transparent whey in which the microscope has not previously discovered any organized corpuscles. But in such cases experience is very untrustworthy, knowing as we do to-day that germs exist almost everywhere. Furthermore, in a protoplasmatic mass the granulations may act as nuclei in perfect cells, and therefore as first motors for cellular multiplication.

The principal propositions proclaimed by Virchow in what is called the "cellular theory" may be reduced to three : (1) the cellule is the characteristic and pre-existent element of all living forms, the conservation and vitality of complex organisms being always due to its confederation ; (2) the protoplasm (or non-nuclear contents of the cells) is the part in which are incarnated the special properties or constant characters of small as well as of large cells, of normal as well as of abnormal ones ; and (3) the nucleus contributes greatly to conservation and multiplication of living elements, serving very little or not at all for cellular development. These three propositions (in their descriptive assertions) seem to be in close conformity with facts, and from this arises the favour which the cellular theory has received; but cellulists have not a correct concept of life as may be clearly seen in the additional proposition of Virchow when he says that "many cells constitute with mutual dependence an individual, and that every one is a vital unity endowed with its own or inherent existence, having in itself alone inherent and personal activity from which the vital functions emanate." This proposition expresses a concept of the cells as erroneous and confusing for Biology as is the materialistic concept of atoms in Physics and Chemistry, and the same arguments we have employed to rectify the idea of atomism may be here applied to the ideas of the cellulists, and, consequently, it is not necessary to repeat them. In reality the word *cellule* is only the expression of an abstract concept derived from the ultimate generalization of Comparative Biology; it represents a single vital element of analogous organization everywhere, and therefore the anatomic elements constantly formed in complex existences must be deprived of all the particular characters which have operated in their development, as form, cell-wall, and nucleus. Accordingly we must recognize that protoplasm may generate by excision two or more individuals from one alone, even if it exists in a diffuse, amorph mass of semi-liquid consistency.

We see that there are no great essential differences between the two mentioned schools; that the ultimate conclusions of both are inadmissible in Biology, because Robin's as well as Virchow's notions of life are contradictory to the fundamental principles of a true physiological theory in which must be avoided all idea of the independence of any part of nature, an idea from which transformism has sprung.

There are two other doctrines of cellular reproduction, besides those already mentioned, both of which are ordinarily confounded with that of the blastema, though at bottom they are different. We refer to the genesis of cells by protoplasmatic granulations, and also by inorganic matter (cellular abiogenesis). According to the granular genesis (maintained by Hughes Bennet, who is its most characteristic representative), the ultimate elements of organism are neither cells nor nuclei, but smaller granulations necessarily born from disaggregation of organized corpuscles, such granulations being endowed with properties by virtue of which they unite among themselves outside the cells as well as within them, in order to engender visible forms, namely, nuclei, cells, fibres, and membranes. Bennet calls attention to the same kind of observations as do the upholders of the blastema, which might in that view be considered as a conglomeration of such elemental granulations; and another point of similarity between Bennet's hypothesis and the doctrine of blastema is the admission of the direct engendering of other cells by different ways of excision after the cellular organism is constituted.

The doctrine which admits "spontaneous generation" of organic elements is called also "heterogenesis;" according to this the anatomic elements may be born in the interior of organisms without the direct formation of cellular germs, whether embryonic or of the same species. But such an idea has arisen from the lack of means for true observation, as to-day, after a deep analysis of the facts which have tended to that belief, we see that most of the germs which they considered as formed simply by molecular aggregation are engendered by continuous or direct generation from parents of the same species. In reality the phytoparasites as well as the zooparasites and the other formations which appear to be spontaneously engendered, are developed from very minute organic corpuscles, ovules, embryos, and vesicles, especially existing in the atmosphere.

§ 47. BRIEF IDEA OF NUTRITION IN PARTICULAR.

The changes of nutrition are the primary changes which are manifested in all organism. A constant interchange of matter takes place between every organic existence and the cosmic medium around it. In living bodies there is an incessant incoming and outgoing, the great metamorphosis taking place within the body. In organism both kinds of chemical reactions are produced: endothermic, which are generally called reductions, and exothermic, which are generally called oxidations; the former consist in the combination of carbonic acid and water, with the reduction or elimination of oxygen in order to form hydrocarburates (ternary compounds of carbon, hydrogen, and oxygen), and nitrocarburates (quaternary compounds of nitrogen, with these three mentioned elements, and generally sulphur besides). The oxidations in living matter are reactions contrary to those of reduction as they consist in the decomposition of the before mentioned ternary and quaternary carburates, carbonic acid and water resulting, for which the compounds must be provided with the quantity of oxygen that was eliminated in their formation.

In this abstract study of nature the two mentioned metamorphoses are the only chemical reactions worthy of consideration. But it is necessary to remark that although both kinds of metamorphoses are produced in all living matter, there is great difference in their relative preponderance in each living kingdom. Chemical reaction predominates in plants, and oxidation in animals; plants are elaborative machines of organized matter, they destroy very little in their oxidations, while animals, on the contrary, destroy by oxidation more organized matter than they elaborate, and for this they need to appropriate or assimilate vegetable substances. Hence the animal is a machine in gradual combustion by means of which the substances which are taken by the plant are returned to the inorganic world in order to form organic structures. In this manner the constituent matter of organism is constantly in circulation; the substances are always the same under chemical analysis, but they are transferred, undergoing great metamorphoses, from the vegetable to the animal kingdom, and from this last to the inorganic, which is the cosmic medium from which the vegetable world assimilates again the matter necessary to its finality. Sun-radiation or photothermic emission, which in greater part results from simple reflexion, is the inciting and providing agency for the energy necessary to accomplish such molecular or thermo-chemical changes. The progene (or imponderable ether) is absorbed by the green colouring matter called chlorophyl, which is the chemical laboratory of the plant, because it is the field where carbonic acid and water are decomposed, and the nascent elements are then assimilated and combined, forming the ternary and quaternary bodies called hydrocarburates and nitrocarburates. The quantity of progene accumulated and confined in organism is enormous, as any of the ternary compounds needs more than five hundred calories for its formation, and when it is freed from such combinations it becomes manifested principally as heat and muscular work, and we must observe that the last form of manifestation of energy after muscular work is also heat. This is propagated by conduction and by radiation, losing, principally in conduction, great part of the living force or manifested energy by transference into a potential or non-manifested energy which is a progenic state. In this manner the circuit of progenic circulation is closed with itself alone, as it can never be changed into any one of the forms of ponderable matter. Accordingly, there is a twofold circulation in the world, one for ponderable matter and the other for progene, a great difference existing between the two as the former is never in a potential state; it is always manifested to the senses, while progene passes from the potential to the phenomenal or manifested state by the generating action of vitality, and from the phenomenal to the potential by all the successive mechanical works of cosmos, including in this the process of disassimilation in living matter, and, of course, all that is derived from it either in a direct manner in living bodies, or indirectly as occurs in all the changes of inorganic machines. Consequently the decomposition of carbonic acid by plants is the initial phenomenon or first manifested change of vitality, and, therefore, of cosmic involution; its proximate cause is progene in translatory movement, whose generation is supernatural and not mechanical; it is a mystery of the Supreme Generator. Such progenic currents carry the molecules to the positions they must occupy in organic structures; these once formed, all the other changes in the world are produced, not by generation, but by propagation with loss of living force. Thus from organic disassimilation all the molar works of the world are derived, namely, (1) muscular contractions; (2) gravity; (3) planetary movements; (4) terrestrial magnetism; and (5) the work of inorganic machines, whether they are directly moved by progenic oscillation (as steam engines), or by progenic currents (electro-motors).

There are no phenomenal differences between a chemical reaction within and outside of living bodies, that is to say, the manifested changes of nutrition are but thermochemical phenomena analogous to the simplest metamorphoses of the inorganic world; the difference is only in the action of the remote cause which sets progene in a uniform, variable movement capable of producing sensual changes, taking it from a state in which, if it underwent any variation, the latter would be beyond the reach of our senses. The presupposed differential character considered by many authors as existing between nutrition and inorganic reaction is only a grotesque representation of irreflexive experience, for in any combination there is true intussusception, and not alone in nutrition as they assert. Some authors vainly pretend to explain nutrition by living fermentation or biocatalipsis, but this is no more than a play upon words, as these last terms can be but verbally defined by the first word. Nutrition cannot be really defined; it is the ultimatum of all phenomenal inquiries, and can only be described with a view of taking the clearest idea of it that is possible.

The movements of matter in its circulation through organism are of two kinds, visible and invisible; the former are molar movements, ordinarily called circulatory, and the latter are of two orders, molecular and progenic. Molar circulation is a concrete or particular study of a special system, and it cannot be the object of general considerations. Moreover, it occurs also in aliments and secretitious liquids, but all depending on muscular work. Molecular circulation exists in nutrition, osmos (endosmos and exosmos), filtration, and imbibition, but all these are, in fact, but one with quantitative differences, because living elements are never like inorganic or dead membranes; for every element assimilates according to its form of activity, and to this, filtration, osmos, and imbibition are subordinate. Of the circulation of progene in organism we have no special knowledge; we can only make the application of the theories of progenic physics to the functions of vitality (see "Theory of Physics").

We cannot go into minute details about the circulation of matter in organism, because we enter at once into the province of Concrete Biology; it is sufficient to give a brief idea of the different acts comprehended in the nutritive function in general. But even for this we have only a very defective knowledge of Physiology, as we cannot follow the evolution of matter step by step in organism; we must limit ourselves to what is known, and this reduces us to very narrow bounds. Let us suppose a cellule alone floating in a medium which contains the elements necessary for its existence; its constituent matter undergoes gradual combustion (oxidation or internal respiration), the oxidated material which is already useless for the necessities of the living element is eliminated from this (excretion), but at the same time some matters pass from the medium to the interior of the cell (absorption), being appropriated and converted into principles analogous to those which were lost by oxidation (organic reparation), in this manner completing the circuit. These four acts are the fundamental movements of nutrition, and are grouped under two heads: assimilation (absorption and reparation) and disassimilation (oxidation and excretion).

§ 48. CLASSIFICATION OF VITAL FUNCTIONS.

In a complex organism life is not sustained by any of its systems or apparati in particular, every one is subordinate to or dependent on the others, so that vitality then results from the interaction of the different systems and apparati with one another. From such a vital interaction a material circulation in all anatomic elements is produced, as we have seen in the foregoing section. The thermochemical change called nutrition, is the sole characteristic function common to all living matter, as all that is alive is endowed with the capacity of nutrition, and this function occurs only in that which is alive; but we cannot say the same of the other living functions, at least in a relative sense, that is, as we infer from the sensual data taken from the manifested changes of the anatomic elements when fully developed. It is a fact that in the fetus, including the embryonic elements and the first that are derived from it, all cells possess, not only the nutritive capacity, but also the reproductive, sensitive, and contractile; nevertheless, when the economy is in full development, the anatomic elements differentiate from one another by the increase of one of the three last-mentioned activities at the expense of the other two in such a manner that they seem to have only one specific function. Thus, in the adult, some epithelia acquire the reproductive capacity, not only elemental or partial, but integral or complete (genesis of the species); some cells and fibres propagate between certain parts of our body progenic currents which are not pure progenic changes, as they experience in their course transferences into molecular changes and *vice versâ;* and some other fibres acquire the contractile power in order to produce the molar work necessary for the locomotion of the body or of some of its parts. We must understand that the three specific functions of some elements are subordinate to nutrition, as every one of them presupposes a change of material circulation. From this arises the classic distinction between nutritive and functional irritation, but such a distinction cannot be made in reality, because no change can occur in the specific function of any element without a previous change in its nutrition, nor can a change in this be produced without disturbing the cardinal functions—innervation and muscular contraction. On the other hand, nutrition and reproduction are both but different forms of genesis; the first is molecular, and the second cellular, each being the complement of the other in organic evolution. This is sufficient to stamp as erroneous the division of organic changes into nutritive and functional, as at present held by most biologists. Formerly the usual division of the changes of organism was into vegetative and animal, the former comprehending nutrition and reproduction, and the latter contraction and innervation. According to such a distinction animals should be considered as formed by the addition of the nervous and muscular systems to a vegetable organism, which is constituted only by the connective and epithelial systems. We have already made a criticism setting aside such a classification.

All the changes of vitality, which are briefly denominated functions, may be classified into two groups—phenomenal and potential functions. We may divide the potential functions into protogenesic (primordial) and deuterogenesic (secondarily derived): the former group is the proximate cause of trophic or nutritive changes; and the latter comprehends the states of progenic tension (potential heat and static electricity) and of progenic current (dynamic electricity). All potential functions, then, must be directly referred to the same medium—*progene*—which is the material agency of similar changes in inorganic bodies; in this manner we avoid admitting any special fluid in organism. Thus the functions qualified as nervous, which consist in acts of non-manifested propagations producing either sensations or muscular contractions, are only progenic changes, combined with molecular (thermochemical) transferences.

In all manifested changes or phenomenal functions ponderable matter must vary its place, and this movement may be either molecular or molar. Molecular change is the first which appears to be engendered in the correlative succession of organic phenomena; it is known by the denominations of trophic or nutritive function, which combines in itself two kinds of phenomena, thermic and chemic, and therefore we may say that the characteristic of nutrition is purely a thermochemical change. Molar movements of organism, that is, those which are visible, are of two kinds—excision or division for the multiplication or reproduction of organic structures, and returned or contractile movements for the locomotive function of living matter.

We have, then, three latent functions or potential changes of organism, and three others which are manifested or phenomenal. In order to show the classification more clearly, we give it in tabular form, as follows:—

Potential or non-manifested functions.	Primordial function; *i.e.* protogenic function or *protogenition.*	*Biogenic potence*—changes of progene which must take place in order to determine the nutritive metamorphosis.
	Secondarily derived functions which may be either in the state of *tension*, or current—*innervation.*	1. *Progenic tension*—static potence or progene in equilibrium in its two forms: potential heat and static electricity. 2. *Progenic current*—dynamic potence or progene in propagating conduction in order to be able to produce effects by its discharge at a distance—innervation.
Phenomenal or manifested functions.	Molecular movement — *nutrition.*	*Trophic function*—the first and fundamental manifestation consisting in thermochemical changes which result from the intermotion of progene with atoms.
	Molar movements which may be either dividing — *reproduction*, or returned —*contraction.*	1. *Reproduction*—first visible movement manifested in living evolution consisting in individual multiplication by division of some organic mass. 2. *Contraction*—a movement of reduction followed by relaxation, manifested to the naked eye in the action of the muscles, and under the microscope in the protoplasm.

Accordingly, all the acts of vitality have been grouped under six headings or kinds of function, namely, protogenition, biotension, innervation, nutrition, reproduction, and contraction; the last two correspond to visible movements, and the four preceding to invisible (progenic and molecular). Here we must call special attention to a function worthy of consideration, although it refers only to a part of the natural kingdoms, this is innervation. Progenic currents are ordinarily propagated in living bodies through the nervous system, which in very well developed organisms contains afferent and efferent conductors ; the former are called estesodic because they propagate the progenic movement which determines sensation, and the latter are called kinesodic, because they propagate the progenic movement which regularly provokes muscular contractions. Such a progenic current resembles dynamic electricity, with the only difference that nervous propagations are under the direct influence of the nutritive process of the nervous elements, which, acting as translatory apparati, produce a great diminution in the velocity of the current.

§ 49. CAUSE OF VITALITY.

Let us now discuss this very important question in order to show that it is a metaphysical problem, and therefore beyond physiological knowledge. We shall try here to expose and criticize briefly the principal doctrines that have been advanced to explain organic generation—the primordial act of vitality. But such doctrines are of two kinds ; some pretend to give a genesic explanation of vitality, while others presume to know the cause of evolution because they give a descriptive enunciation of facts. (These last have been criticized before.) The former, at least, have the appearance of explaining a primordial cause ; nevertheless they only give verbal explanations of the genesic act, and these do not teach any true proposition, and consequently do not resolve any difficulty ; such doctrines only remove the solution of the problem to a greater distance, and complicate it still more as they presuppose intermediary agents between the Primordial Cause and physiological effects. Such is biontological animism according to which every being is an automaton, having besides the soul, a generating potence which is transmitted from generation to generation. Such also is vitalism (a monoontological doctrine), according to which the cause of material and mental vitality is the same thing endowed with the two potences. Vitalists consider that the cause of living autonomy is different from physical action; that the character of the "vital principle" is the generating activity of matter as well as of mind, while the character of physical potence or force is movement. But from this argument we cannot logically arrive at the conclusion admitting such an intermediary agent in nature. Some vitalists try to explain life by admitting a directing and creating action only at the beginning and growth of organism which disappears as soon as the evolution is completely instituted. But when may evolution be considered as completely instituted? This is another difficult problem besides being an unknown ontological agency.

Claude Bernard says that the destruction of organism and its regeneration is a completely special activity which depends on "chemical agents" inherent in organism. This doctrine, which we may call chemical vitalism, has as frivolous and false a foundation as the foregoing. The reflection which effectually led Claude Bernard to such a conception was the absurd supposition that the physico-chemical phenomena of living matter, although subordinate to the law of Physics and Chemistry, have some particular ways special only to organism, and of which inorganic matter offers a very inexact image. It is very strange that men of such great investigating talent proclaim ideas so opposed to the highest principle of our knowledge of nature; for the analysis of all matter reduced to the last elements and changes is the same in the inorganic as in the organic world, the last differs from the first only in its morphologic and phenomenal synthesis.

There can be no doubt that the determining cause of the morphological and phenomenal synthesis of living matter is something very different from inorganic matter, as in this only changes with loss of living force can be produced; the generation of living force can never be effected by inorganic matter, it can be effected only by the action of the Supreme. Great care is necessary in treating of this question in order not to fall into wrong interpretations. In nature there are no new creations; all changes result from simple mutations or transformations of existing realities, but the reparation of the loss of living force in the world and the unity and concert which constantly reign throughout the organic system, and consequently in the whole universe, cannot be produced by inert bodies phenomenally considered. Hence the primordial act of vitality obeys a supernatural government, and it is a complete mystery how the Creator directs the germs to follow the characteristic evolution of their species, growing and procreating by specific excision or division of an anatomic element (cellule) into two or more. The manifested changes of vitality and all the metamorphoses of the inorganic world are derived effects of material interactions or intermotions, either among the parts of organism, or of this with the cosmic medium, or else of the parts of this inorganic medium among themselves.

Most authors at present affirm that organism is *irri-*

table, meaning by this that it reacts by itself alone against an external influence simply by action of contact, that is, without any propagation from the exciting agent to excited organism. But reactions of this kind are seen in chemical metamorphoses of inorganic matter. Nevertheless, most physiologists state that *irritability* is a characteristic and primary activity of organism, and consequently they make all the manifestations of living beings dependent on it. They say, besides, that irritability, being a reaction of living matter, must be provoked by some external agent called "irritant," in order to become manifest, and as the activity of the living element is manifested under different forms, according to the conditions of the organism and of the irritant agent, this is called by physiologists irritation, which, they say, may be either genesic or nutritive, or else functional (external work). But those facts called irritation, rightly interpreted, are no more than another and improper name for vitality. Hence, irritability must not be considered as a primordial force of organism, but as a figurative name for the first change of living bodies, that is, as the ultimate abstraction of the unknown potence which acts as the primary effect of all organic manifestations; it is, then, what we have called protogenition.

In the general concept of matter we have explained the meaning of the abstract terms "mass" and "movement," and here we must explain the correlative organic terms "protoplasm" and "irritability." All the arguments employed to convince us that mass and movement are merely concepts or mental abstractions, are equally applicable to the concepts of protoplasm and irritability. These are nothing but words, comprehending all the abstractions referring to organism in general, for any organized object is in reality one alone, and not an aggregate of organs and functions. Hence protoplasm and irritability signify only the ultimate notion of living attributes, and therefore represent the limit of generalizations in the inductive process regarding living bodies.

Physiologists, whether they have forgotten or ignored the true ideal signification of such abstract terms, have arrived at the erroneous conclusion that living phenomena are simply consequences of attraction and repulsion, resulting from the concurrence of some elemental substances, and consider nature as a continuous succession of cause and effect, subordinate only to those mechanical laws which they consider as the Primordial Cause, and therefore they suppose objects endowed with inherent power of transformation, which has determined in the universe, they say, a vast process of development or evolution.

We do not tire of repeating that the mental necessity of abstractions in the formation of thought, and in its communication by language, must not be confounded with the concrete nouns which represent things existing in reality. Thus, there are not two independent beings, one static and the other dynamic; this distinction is only a verbal one, imposed by descriptive discourse, and nothing more, and therefore an organism is not a compound of protoplasm and irritability; on the contrary, organisms are chiefly constituted of living matter called protoplasm; but we must not forget that such a qualification as vitality does not represent any abstract force that can produce living reactions (as irritability, etc.), but the mechanical result of the combined intermotions in organism. How many discussions ending in confusion have been maintained in all centuries by men otherwise very distinguished in science who mistook such a separation, which is purely verbal, for a real one.

Accordingly, there is no such thing as irritability in the sense of a vital force. No principle of vitality can be admitted as inherent in matter, and consequently the hypothesis of transformism is quite baseless in Biology. Nevertheless, the transformists have discovered some general laws which are empirical, and which help the assimilation of descriptive science.

What is then the interaction between the Generating Cause and progene? This is a metaphysical problem. Physiology only investigates the successive changes which are effected in organized structures already formed. Neither can the selective organizing power of vitality, which is the sole cause of promotion in nature, directly operate more than in living bodies, nor can an organism be formed by only a transmutation or transference from phenomena or material changes. The cause of vital power in itself must not be included in the physical investigations of the successive changes of the universe, because we cannot know by the senses, nor can we derive from phenomena alone the knowledge of the Primordial Cause which constantly perturbs nature in its well-ordered concert. We must not include in the physiological concept of cosmos the primordial genesis of Metaphysics—Cosmogony, for this doctrine has nothing to do with objective sciences.

Organism, to obey the power of collocation which determines its reproduction and development, needs ponderable matter to constitute its tangible structures, and imponderable matter to employ as a mechanical means in transferences or indirect transmissions. In this manner organism is the origin of all natural phenomena, realizing a work of production of living force at the expense of potential energy, in order to repair the dissipation of manifested energy in those partial systems called mechanic. Effectually living bodies appropriate cosmic potence (latent progene) and surrounding matter to form organic structures; and to generate such a complicated collocation of material it is necessary not only to assimilate ponderable matter, but to restore the progenic energy which is freed in the moment of decomposition.

We can show at a glance the difference between mechanic and genesic work by means of brief formulas, representing by small r the resulting living force of a change, and by small f the living force expended. Then we have the formulas—

$$\begin{aligned} &\text{Mechanical work} = \text{M is } r < f. \\ &\text{Genesic work} \quad\; = \text{G is } r > f. \end{aligned}$$

And representing by capital R and F the sum of the resultant and expended forces in the whole cosmos, including potential state, we have—

$$\text{Cosmic work} = \text{C is R} = \text{F}.$$

We know by Mechanics that the work of any trans-erence may be presented in round numbers thus, $r = f/_2$; nd, therefore, with the guarantee of the principle of onservation of energy in the universe, we infer the ormula of genesic work in round numbers $r = 2f$. This s the formula of the great secret of nature, as it repreents the antagonistic and repairing action of mechanic issipation. The total work of cosmos comprehending oth $f/_2$ and $2f$ which we represent in a whole by R may be condensed in the formula $R = F$, that is, conservation of energy. In this last formula and principle we must take into account the constant conversion of living force in mechanism into latent by the determined resistance of centrifugal oscillation and the centripetal pressure of progene on ponderable matter, that is to say, by thermic potence, and principally by the resistance of gravity.

Mechanical or artificial synthesis must not be confounded with biological or natural. The difference does not consist in the possibility of producing any change whatever. When a chemist combines carbon, hydrogen, oxygen, and nitrogen to form immediate principles, he cannot do it as an organism, because he needs to employ a living force greater than the resultant. In the same manner, if a chemist in the future should be able to accumulate the immediate principles in order to form protoplasm, it is certain that the work then produced will be under the same mechanical condition, that is, according to the formula $r < f$ or $r = f/_2$—phenomenal resultant about half less than employed force (excluding that which is latent). A chemist will never be able to do that which is done by an organism, to elaborate organic matter with the formula $r > f$ or $r = 2f$, that is, phenomenal resultant twice as great as the expended living force; this is a problem which Chemistry cannot resolve, no more than Mechanics can ever resolve the problem of perpetual movement, which is a cosmic work according to the formula $R = F$—resultant equal to the expended force. This is sufficient to set aside all transformistic ideas which try to explain the origin and evolution of nature by matter alone, the only principle which transformists admit in the universe.

Many scientists believe that in the future chemical synthesis will be able to explain organic generation, basing this belief on the sole reason that they expect to elaborate all the immediate principles of organic bodies. But this would not be an organic synthesis, it would be only the first link in the chain of successive analysis. Furthermore, even if we suppose that the chemist of the future in the laboratory may reach that point where he can associate the immediate principles to form a complete organic structure, is it logical to deny an elaborating intelligence to the natural laboratory of a living body, when we necessarily admit it in the artificial one? Such a primordial organizing intelligence is not, in truth, perceived by the human mind because no one can be conscious of another's intelligence, but it must be conscious in the Divinity itself (it being contradictory to suppose an unconscious intelligence), and in it alone are the purpose and finality of objects or natural beings.

The conditions of the cosmic means are never complete or perfect for the development of an organism, as in the successive intermingling phenomena of cosmos there is always some deficiency, and so in a finite number of objects we never contemplate absolute qualities which can be attributed only to the Infinite. The Infinite alone can be true, good, and beautiful in absolute; only the universe as a whole is a true, good, and beautiful system in absolute; one part alone, as the living body, cannot be more than relative in all and for all.

§ 50. RECAPITULATION OF THE CONCEPT OF LIVING MATTER.

Organic genesis comprehends individual evolution during the time an organism preserves its existence, and reproduction of species when the multiplication of beings is produced.

Individual evolution may be summarized in the three following propositions:—

1. The vegetable world produces transferences of progenic energies, propagated from the inorganic world into molecular energies, while the animal kingdom transfers the progenic and molecular energies which it draws from the vegetable world into molar energies, and restores to the inorganic world the progenic power which was transferred into molecular by vegetation.

2. In both living kingdoms such acts have as the first manifestations of vitality, chemical metamorphoses, whose force is measured by calories, and therefore calorie must also serve as a standard of comparison to determine the relative quantivalence of vitality. This concept is indispensable for the progress of Biology, for which we must take as a base the law of maximum work when we discover the transformations which take place in every being, and the degree of stability in its composition.

3. The potence which is the limit of our physiological investigations is progenic, admitting and recognizing that the Generating Cause (Creator) constructs organic structures by means of currents of progene in the same manner as inorganic combinations are formed,

because at bottom organic as well as inorganic reactions are only material combinations or changes in molecular extension and complexity.

In Part I. we have demonstrated that all forces are measures of resulting movements, and that all physiological laws express only relations among the effects of nature; neither forces nor mechanical laws are generating causes which could produce primordial effects. That tendency of modern authors of Physiology to explain all natural phenomena by variations in the structure and configuration of bodies, is, therefore, a pretension not to be realized; otherwise we should only have to invert the terms of the phrase, and then say that the formation and configuration of organic structures are explained by themselves. But this is evidently false, because the greatest analogies in the germs of organism correspond to the greatest individual differences in their ulterior development, that is, in the phenomena of their succession.

The collocation of matter in organism is an inconceivable change, it is completely opposed to the facts of inertia of matter, and needs therefore the action of immaterial influence. By propagation of movement alone we cannot effectually construct any organized body even theoretically, because, as we have already seen, in it the contrary happens to what takes place in an inorganic machine; there is a conversion of latent power into manifested, from this resulting the generation of actual and disposable forces, instead of the dissipation of living or phenomenal energy, as we see constantly produced in any pure mechanic means, complicated and perfect though it may be.

The power of generation, or of collocation in organism is metaphysical; we have sufficient reason to declare fully, that there is no possibility of explaining the construction of living matter more than by the influence of an Intelligent Cause, which cannot be perceived by our consciousness. The generation of potence which directs the collocation of organic principles in the construction of a living body is as enigmatic as the creation of inorganic material.

Cellular multiplication. A complete exposition and discussion of the various doctrines of organic generation would be almost interminable, and we will confine ourselves here to recapitulating only the principal ones, and these as briefly as possible. All may be comprehended in two groups; one embraces those pretending to give a genesic explanation, or to discover the original mystery by vain words representing abstract forces as biontologic animism, vitalism, directing and creating force, vital affinity, and so on; and the other group comprehends the descriptive explanations of the formation of new cellules, as the so-called cellular and blastematic theories.

Some histologists, of the French school in particular, maintain that among the morphologic elements of organic tissues there are semi-liquid substances that almost always contain elements of new formation, which they suppose to be formed by a kind of free condensation of some semi-liquid they call blastema. Those who maintain this free cellular formation admit it in the following cases: (1) generation of the reproducing elements (male and female); (2) formation of the first elements of an embryo; (3) generation and regeneration of epithelium; and (4) generation of the greater part of pathologic neoplasm.

The cellular theory is principally held by the German school, and is to-day the most widespread throughout the world. Its propositions may be expressed in the following terms: (1) the cellule is the characteristic and pre-existent element of all living forms, the succession and conservation of vitality being linked to it; (2) the nucleus is the part which contributes most to sustain and multiply the living elements; (3) the protoplasm is the part which gives to the cellules their special characters; and (4) every cellule of those forming a complex organism is an individuality which possesses in itself its own activity from which its functions emanate.

This last proposition expresses as erroneous a concept of the cellule, as does that of physicists and chemists about atoms. This parallel once made, the same arguments which were employed against modern atomism are applicable here. Thus the cellule is the concept of a mental abstraction of an ideal protobio (from *protos* first and *bios*, life), by means of which it is represented, in language as a simple element, always analogous and constant in all living bodies, thus stripping the cellule, which has a true cellular figure, of all that is particular in its real or concrete existence. So that reproduction by excision of the protoplasm is admitted, although this may be under a diffuse, asymmetrical, and perhaps semi-liquid form. On the other hand, without detaining ourselves here to investigate the existence and functions of blastema, it is sufficient to remark that the two schools, French and German, do not differ essentially in their fundamental concepts, and that both are contradictory to the true principles of physiological theory, as they aim to inculcate independence among the parts of the system, so sowing the baneful seeds of transformism.

All living beings, elemental as well as complex, are subject to a fixed, determined evolution, being necessarily born from a germ ; our organism, as well as every one of the living elements which constitute it, must be engendered in direct succession : *omne vivum ex ovo*, equal to *omnis cellula a cellula*. We recognize the truth of this assertion of the cellular theory, but we interpret the term cellule in the most extended sense according to abstract signification, including in it even the free masses of protoplasm ; although in general, especially in superior beings, the generating elements have their own form more or less like a typical cellule.

After birth, all individuals follow three successive stages during development—growth, fixed condition, and decline to death. Growth depends on the sum of the interaction of constituent elements, producing an increase of the anatomic elements already existing principally by new elements formed by multiplication of those preexistent. The form of organic growth explains the other two stages in the evolution of life, because they grow in their totality relatively more on their surface as the ratio of the cube to the square. The molar work, also, principally in animal life, is greater in proportion to the growth without increasing the ingress of matter, and besides the constant diffusion of liquids through the membranes leaves mineral substances incrusted in them, eventually producing their true mineralization, which decreases their endosmotic power and therefore their activity for the interchange of matter.

CHAPTER VII.

CONCEPT OF PLANETARY BODIES: ORGANIC AND INORGANIC MATTER TOGETHER FORMING WORLDS (ABSTRACTION BEING MADE OF INTELLIGENT POWERS).

§ 51. Aggregates of organic and inorganic bodies—§ 52. Brief description of the earth, sun, and moon—§ 53. Terrestrial gravity—§ 54. Planetary movements of the earth and terrestrial magnetism—§ 55. Recapitulation of the concept of planetary bodies.

§ 51. AGGREGATES OF ORGANIC AND INORGANIC BODIES—(WORLD OR PHYSICAL COSMOS).

The worlds are composed of the two kinds of bodies, inorganic and organic; the inorganic are in different physical states (solids and fluids), and the organic constitute the two living kingdoms (vegetable and animal). We must now give the fundamental analogies and differences between living and non-living bodies, as well as a summary of their distribution in our world, although this last point is more especially reserved for the next section.

From the material analysis of living bodies only a few chemical elements result which are the same in dead bodies (corpses); they exist equally in the most inferior beings and in man, and they are profusely scattered throughout the inorganic medium. Nevertheless, reflecting on the characters of life from the ovule or organic germ to its development and death, there is no doubt that in it we discover functions which consist in a system of changes never observed in synthesis outside of living bodies; but in analysis all the changes of vitality are exactly equal to the potential and phenomenal states that have been discovered in the inorganic world. Hence, the organism, physiologically considered, is only one of the phases of matter; in a material sense the organic germ, then, consists simply in the combination of the elements which are discovered by chemical analysis as forming an alotropic state of the matter common to both kinds of bodies. But is this a condition sufficient to determine the actions of the different parts of our organism, among themselves and with the external medium, in such a manner that a living body could be considered as a peculiar form of redistribution of matter regulated only by mechanical laws? Although we have already answered this question negatively and have demonstrated our assertion, this point needs further consideration in order to explain our fundamental proposition: we admit that the true Primordial Cause, which is the metaphysical subject to be treated of on supernatural grounds, acts directly upon living bodies, giving them the necessary direction to build their organic structures; but we do not recognize any essential difference in the effects which constitute all possible knowledge of the physical object or natural ground. The manifested differences between organic and inorganic bodies are only quantitative and not essential; this point, in analysis, has been already elucidated in the general concept of matter. Now let us consider it synthetically.

Perhaps our mind might be a little better satisfied with the idea that the natural elements of an organism, *i.e.* those which are manifested, are the sole agents in relation to vitality, if all organisms were identical, having the same configuration and functional evolution; but living bodies are of very different forms, and have the most various evolution in opposition to their identity in their material composition. The complete proof of the necessity of an essential cause of life different from the mechanical propagation of movement belongs to Metaphysics and not to Physiology (Natural Sciences), as this in its inquiries must not go beyond manifested effects and their proximate cause (material potence). The inquiry into the Primordial Cause does not concern Physiology, which must limit itself to the study of Cosmic Mechanism, but this is no reason to forget and still less to deny the principle and end of objective *nature*—the Supreme Intelligence to which physical cosmos must be subordinated merely as a supplementary medium. Thus, then, we consider the world as a whole in which living matter is the direct medium, and dead and inorganic matter the indirect medium to accomplish the supernatural aim. Accordingly, it is not out of place to state that true physiological science is not opposed to theological belief; though badly interpreted in their principles, they have been considered by many as contradictory; on the contrary, the Science of Cosmos, according to our physiological theory, is in complete harmony with true Monotheism, and subordinate as a supplement to the subject of true belief. This maxim we must not forget, lest we fall into the erroneous view of those who, intoxicated by the fantasy of the present positivism, pretend to subordinate everything to the much-talked-of "experience," when this consists but of sensual appearances often highly deceptive. Nevertheless, let us see what experience teaches us, but only when guided by sound reason.

The corporeal species are defined either as chemical species or living species; the former can be produced by decomposition of organic structures or by chemical combination of different elements, while the latter cannot be produced either by decomposition or by combination of different elements. Besides, in the formation of complex inorganic bodies, the resulting substance is very different from the producing or original ones, while organic bodies are necessarily engendered by a complex individual of the same species, and better to say, the new body is no more than one part of one species, sole matrice of all the individuals which are separated by excision. So it results that the engendering body and the engendered one are analogous, and that the last formed part of the first with all the conditions of a partial existence, depending on the individual. But the two kinds of corporeal species are not independent nor essentially different, they are complementary, because there is no new creation of material; every increase in one kingdom supposes a diminution in the other and the reverse; such change of material circulation is constant, but the prime object of such incessant change is the organic world, and the secondary medium is the inorganic world; that is to say, the former is the place where the first effect of primordial action is produced, while the latter serves only as a conditional medium for the interchanges of the organic world. Therefore, in the relative succession or relation of derived causes the activity of the inorganic world is a secondary effect subordinate to vitality; the genesis of this is a mystery and the only one of its kind in the world, as any other change may be explained by mechanical propagation.

The growth of both kinds of bodies is operated in similar ways: either by molecular combination or intussusception, or by molar aggregation or juxtaposition, with the only difference that living bodies increase almost exclusively by intussusception, while dead and inorganic bodies, on the contrary, commonly increase their bulk by juxtaposition. But there is a still more remarkable characteristic in the growth of living bodies, that is, in the morphologic concept; they must have a peculiar form and limited dimensions while the existence of inorganic bodies is compatible with an indefinite number of forms and is also capable of undergoing the greatest increase or diminution in dimensions. Organisms have, besides, another morphological character very well defined: they are necessarily of some solid consistency, they cannot be fluidified; while inorganic bodies can be changed in their physical state, those which ordinarily are solid may undergo either liquefaction or evaporation or else both, and even if there is an exception, like carbon, which is a fixed solid body, that also may be dissolved (by combination) in some liquids and solidified again (by decomposition of the solution), becoming the same corporeal species as before. Liquefaction by any means in living bodies determines their death, and consequently they cannot be afterwards restored to their former state. Again, the limit of the existence of living bodies is formed by molar division, while it is illimitable in inorganic bodies. In this sense we may say that organic bodies have a definite existence in space, and therefore are specific in their morphology, while inorganic species are variable, morphologically considered, and therefore have an undefinable existence in space.

Living bodies are not only defined in their relations in space, but also in time; the duration of every individual is limited, ending always by decomposition or corruption, and beginning by birth. Generation is an activity existing only in the living species, and not in any object outside of that, while the elaboration of a chemical species is necessarily produced by one or more species different from the resultant; thus, for instance, to form water we combine hydrogen and oxygen.

We might enumerate many other morphologic and phenomenal differences between living and inorganic bodies, but all are, of course, relative or quantitative, because, as we have repeatedly said, we are not able to perceive objectively or by means of our senses any other characters than the relations of quantity. Thus, morphologic differences do not consist in any qualitative character, for organic matter consists in the combination and mixture of inorganic elements, though in such a manner that a peculiar structure is formed (protoplasm and its derived formations), which can never result as a direct product of an inorganic laboratory. In the same manner, the phenomenal differences between living and non-living bodies, are also differences of aggregation, as may be more clearly seen in the following table:—

1. Known energies primordially derived as functions of organism: vital synthesis. (We do not mention in this table either protogenition or biotension, because they are unknown.)

Invisible (progenic and molecular), movements.	Progenic change: potential transmission (like electricity).	Innervation.
	Molecular change: thermochemical phenomena.	Nutrition

Visible (bodily or molar) movements.	Complete division : cellular excision.	Reproduction.
	Return movement in cellular elements.	Contraction.

2. Energies secondarily derived, common to inorganic and organic matter : mechanical analysis.

Progenic or imponderable energies.	Potential changes.	Quantitative change of progene.	Electricity (static and dynamic.
		Change of progenic oscillations.	Potential heat (latent and radiant).
	Manifested changes.	Translatory movement of progene.	Light.
		Oscillatory movement of progene.	Sound.
Atomic or ponderable energies.	Molecular changes.	Change of intermolecular distances.	Heat (temperature and state).
		Change of molecular composition.	Affinity (chemical change).
	Molar changes : visible or ordinary movements.		

But in opposition to the analogy between the effects there is the difference in the cause, for the physiological synthesis of vitality is produced according to a mathematical formula precisely inverse to that of inorganic machines ; these constantly lose some living force—that which may be manifested in works necessary to fulfil the mechanical aims of man, and the empire of living bodies produces as a definite resultant the reparation in cosmos of the force dissipated in the propagations of non-living bodies. Thus the ovule or living germ constructs a more or less complex building and engenders phenomena at the expense of energy, some of which is potential. This cannot be done by any inorganic machine, nor even can any mechanical works resolve the problem of perpetual movement which exists in cosmos, because all bodies lose 46 per cent. of living energy in any manifested propagation.

It is necessary to be on our guard in order not to be deceived by certain false appearances; thus, on the one hand, electric machines convert potential into phenomenal energy when they produce light or molar work, but electricity must be produced by a living energy greater than that which results from it; and on the other hand green vegetation when very well developed and under the action of sunshine, absorbs a greater quantity of manifested energy than it spends, but we must take into account that such conversion is only a temporary reserve, and that such latent energy afterwards becomes manifested. Accordingly, our reference is made not to every one of the changes of a machine, whether organic or inorganic, but to the whole partial system which constitutes a living body from its birth to its death, and an industrial factory from the beginning to the end of its operations. Then, as we have already said, we may express the differential character of the two kinds of bodies by opposite formulæ; calling the living force expended in a change f and the resultant r we have—

1. Work of organized bodies, . . . $r > f$.
   (Some potential energy becomes then manifested.)
2. Work of inorganic bodies, . . . $r < f$.
   (Some manifested energy then becomes potential.)
3. Work of cosmos (inorganic and organic bodies together), . . . $r = f$.

Now we will call F the sum of the energies in cosmos (whether manifested or otherwise) before any change is effected, and R the amount of phenomenal and potential energies after the production of such change, we have then the formula $R = F$. Here is the mathematical reason and limit of that physiologic principle (or the ing, so to speak) which is known as the principle ervation.

fine, observation never shows us a case of the on of a living body without parents, that is, by combination of inorganic material, and if the influence is never observed outside of living , we must then necessarily suppose that material with its laws is always the purpose and end of natural being—the Maker—by means of organic ion, by which the divine idea is constantly real- ve do not see the same direct connection of the with the inorganic world, whose activity is nate to the organic world, and which is therefore act outside the direct realization of the divinity. lies the only essential difference between the dily constituents of the worlds, which we can entally construct simply by the combination in tem alone of the concepts acquired of both the and inorganic kingdoms.

BRIEF DESCRIPTION OF THE EARTH, SUN, AND MOON.

will here briefly give the principal generaliza- nferring them from the study of our planetary , but particularly from the earth, although in n to this something must be said of the relations, es, and differences between the earth and the l bodies, more especially with regard to the sun on. We will commence with the earth, which consider only in its totality.

ong the Greek sages we see the idea of the ity of the earth already indicated contrary to the irreflexive belief of almost all humanity up to the sixteenth century. But no practical demonstration was made until the modern age, when Magellan (in 1520) sailed from Europe to Asia and back again by doubling the South American promontory. It is well known to-day that the earth is an oblate spheroid, whose equatorial radius is 6,377,398 metres, and whose polar radius is 21,318 metres less; so we see that the equatorial diameter of the earth is about eight thousand miles (12,754,796 metres). The density of the earth, according to geologists, is from five to six, but the average density in the superficial layers of the earth being from two to three, they have supposed that in the interior of the earth there are very heavy substances. But we must not forget that the nearer a body is to the centre of the earth the weightier relatively it is, therefore this condition must be taken into consideration in estimating the true relation of densities at different depths. The temperature of our planet is very variable to the depth of twenty-seven metres; beyond that it can be said that there is a fixed temperature, the thermometer always registering nearly 12° centigrade at twenty-eight metres, the temperature increasing in a uniform progression of one degree for every thirty metres of descent, while, on the contrary, the higher we ascend above the surface of the earth the lower the temperature becomes. In order to simplify the description of our planet, it is convenient to divide it into three parts—the surface, the exterior or atmosphere, and the interior. These we may call in correlation mesogeos, exogeos, and endogeos.

Mesogeos is the surface of our planet, and in its study we indicate only the principal points concerning the irregular distribution of land and water, and also of animal and vegetable life. The highest points of the earth's surface are generally less populous in living beings than the middle heights, and the most depressed parts are covered with water, in which pullulates animal life in particular. At first sight there is found a great disproportion between animal and vegetable life in these three regions, which naturally serves to unbalance or perturb cosmic functions; and thus *change* in cosmos is originated.

We should pass far beyond the limits of this work if we were to explain here the concrete terms referring to the different objective forms of our planet, as seas and continents, mountains and valleys, etc., so we shall restrict ourselves to the data needed for our abstract inferences. We must first notice the vast extent of water on the earth's surface, and its irregular distribution in relation to dry land. It may be said that the greater part of the earth is covered with water, about eight parts water and three parts land, that is, almost thrice as much water as land. The dry land principally occupies two opposite sides of the planet, forming in one part what we call the old world, or Eurasia and Africa, and in the other the new world, or America (North and South). There are other portions of dry land less vast, which are called islands, and which in many cases form archipelagos, the most important of which is Oceanica. The distribution of land and water is very irregular, water preponderating in the southern and land in the northern hemisphere in the proportion of three to one. It is also worthy of notice that the depth of the sea is greater than the height of the mountains, a fact which still further increases the proportion of the surface of the earth which is covered with water.

The uppermost layer of the earth is generally made ground, that is, a thin layer of soil ordinarily modified by the artificies of human necessities, but beneath this is what is called subsoil, which is very commonly exposed to view by the denudation of waters and by artificial constructions, and is seen by comparison to be of many different kinds, as calcareous rocks, sand, chalk, clay, etc. Soil and subsoil may be classified as sedimentary and crystalline; the sedimentary is of aquatic origin formed by the precipitation of dissolved substances, and the crystalline is supposed to have an igneous origin. The state of each in particular is the object of the concrete science of Mineralogy.

Exogeos or atmosphere is a gaseous mixture principally constituted of nitrogen and oxygen in the ratio of four to one. It also includes in its composition aqueous vapour, carbonic acid, and a multitude of microscopic organic and inorganic corpuscles. This mixture, moreover, besides being complex, is very variable in the proportion of the mixed elements according as it is day or night, and according to season, temperature, winds, height, etc. Air is nearly eight hundred times lighter than water; nevertheless, the influence of its weight over other bodies is a matter of great importance, because its height (not yet precisely determined) is more than 100 kilometres, and determines on the surface of the earth a pressure which, measured by the mercurial barometer, is equal to a column of 76 centimetres with slight variations of some millimetres. The knowledge of the succession of more or less regular barometrical variations, as well as of the movements of atmospheric translation (winds) does not belong to this chapter because it presupposes evolution in time and explanations of the reasons of such changes.

Endogeos. We know that the material of which the earth is composed is arranged in layers or strata, which he cutting of any section shows in a succession one above the other. To enter into details of endogeos, *i.e.* about the structure of these layers, is to invade the province of a branch of Mineralogy called Geology which is a concrete science. The only important fact we need treat of here is that deduced from an indication already referred to about subterranean temperature, and that is that if the temperature increases regularly in relation to the depth or distance from the surface, it is clear that at the depth of 100 kilometres (equal to the height of the atmosphere) the heat must be sufficient to melt all rocks, and therefore the greater part of the interior of our planet must be in a state of fusion, the solid crust being relatively very thin.

In the constitution of cosmos the earth is no more than a planet of secondary magnitude. Let us now consider its principal relations to the celestial bodies, especially to the sun and moon, as the sun is in the focus of the ellipse described by the earth in its orbit and annual revolution, and the moon is a satellite which revolves around the earth. Both, by their reflection, greatly influence the changes of our planet principally n the terrestrial fluids, air and water, and above all more directly on the metafluid or progene existing in porocules or the interstices of bodies. We have already ndicated, and we will clearly state in the next chapter, hat we must not consider the sun as the prime motor n the production of terrestrial phenomena.

The idea we form of the sun by irreflexive observation is very deceitful. When viewed through a dark coloured glass it appears like a white disc perfectly circular, whose diameter does not seem greater than fifty centimetres, and whose surface appears homogeneous; furthermore, the solar disc seems to move from west to east, following a curve whose centre is the point in which the observer stands, and whose extremes touch the visible horizon. We know that the more distant an object is the smaller it appears, thus, calculating the distance of the sun from the earth as about ninety millions of miles in round numbers, the true diameter of the sun is inferred to be more than one hundred times greater than that of the earth; the difference between the diameter of the sun and its distance from the earth being almost in the same ratio, 1 : 100. To form some comparative idea of these relations of size and distance, let us imagine a sphere of one metre in diameter at a distance of one hundred metres to represent the sun, and a little ball, one centimetre in diameter to represent the size of the earth and its relative position to the sun. Accordingly, more than a million balls like the earth would be necessary to make a sphere like the sun. But perhaps we can acquire a clearer idea of the extraordinary dimensions and distances referred to by the following calculations. A ball shot from a cannon, moving uniformly with its ordinary velocity, would take about thirteen years to reach the sun, and if we suppose the ball diametrically crossing the sun it would take more than a month in passing to the other side, while it would need only about seven hours in crossing the earth's diameter. We can further acquire some idea of the distance of the earth from the sun by considering that a train running at the rate of thirty miles an hour would take about 350 years to accomplish the distance.

Telescopic observation reveals a fact worthy of mention. The sun has spots which appear and disappear every fourteen days, reappearing on the eastern edge of the disc about fifteen days after disappearing from its western edge. This regular movement of the spots shows us that the sun is in rotation, and that this rotation must be accomplished in about twenty-six days. From this we infer, in accordance with the principles of our Physiological Theory, that the sun has a continent with living matter in order to produce such a rotation, but comparing it with the earth we must suppose that the ratio marking the difference between land and water in the sun is much greater than that of the earth, and we must deduce from this that the great reflecting power of the sun is owing to the extraordinary extent of surface covered with water. We must also explain the lack of orbital movement in the sun by the fact that the surface of the sun in which vegetation can exist, being relatively small, the force of propulsion emanating from it is not sufficient to counteract the resistance of the solar atmosphere, and so only a rotatory movement results. If the sun has any translatory movement whatever, it must be a very slow one, and so t is not worth taking into consideration in this work.

The moon, like the sun, produces many deceitful appearances, among which the most surprising are the different forms it presents during its successive stages, and we see that every twenty-seven and one-third days he same phases are repeated. Nevertheless, it is demonstrated that the moon is an entirely round or regular sphere, and that such phases depend on the greater or less surface which reflects the sunlight. Its distance from the earth is in round numbers something more than three hundred thousand miles (380,000 kilometres), that is, it is about three hundred times nearer than the sun, and therefore at a distance almost equal to the third part of the solar diameter. Accordingly, the space between the earth and the moon is only sufficient to accommodate a body twenty-seven times smaller than the sun. The diameter of the moon is almost one-fourth ($\frac{3}{11}$) that of the earth, and its size is forty times less. The general opinion of authors is that the moon has no atmosphere and lacks water, and consequently cannot contain living beings; but from the general principles laid down in this Physiological Theory we infer that the moon, in order to accomplish its orbital and rotatory movement, requires life as does our own planet. It is not possible to determine the forms of living matter, but we have sufficient reason to affirm its existence.

Analogies exist between all the other heavenly bodies and the sun, the earth, or the moon, but their study is particular or concrete. We only need know as a general fact that the differences among all of them are not absolute, and the transitions are graduated in such a manner that relying on spectroscopic observations we can proclaim the analogy of the constituent material without any other difference than in the proportions of its components, and thus can add that in all the universe perfect harmony reigns in the descriptive relations—those of space, as well as in the genesic—those of activity in time.

§ 53. TERRESTRIAL GRAVITY.

The force of gravity is manifested to our irreflexive experience in two different states; one is movement, which is seen in the falling of bodies through the atmosphere when they are of greater density than the air, and the other is the equilibrium ordinarily called weight. Reason has discovered that both states are but one which results from the intermotion of progenic and atomic matter on account of their different condensation, the ratio being as 54 : 100 (almost 1 : 2). That is to say, an atom must be almost twice as much condensed as a portion of progene of the same volume, but all the atoms of the different atomic substances must be of equal density (the same weight in the same volume) because all bodies fall with equal velocity in an empty tube. This relation is, of course, established, supposing the atoms to be compared in a tube void of other particles.

The force of falling bodies, moved by gravity alone, increases in direct ratio to the square of the distance passed through, and the force of gravity decreases with, or is in inverse ratio to the square of the distance from the centre of the earth. Gravity is not a property of matter, it is only a mental relation from quantitative comparisons. Such a relation is not constant, it is subject to periodical and irregular variations, as is proved by the measurement of atmospheric pressure. If we take into consideration the maximum and minimum changes of atmospheric pressure in different places, on different days and hours, we may discover many curious results, and explain them according to our Physiological Theory; but the consideration of this point alone would be sufficient matter for a book. It must suffice for us to remark here that the average atmospheric pressure on the surface of the earth is equal to the weight of 76 centimetres of mercury (measured by the barometer), and that the widest variation from that number represents only a few millimetres on the mercurial barometer. Most of the barometric changes are periodical, alternately increasing and decreasing every six hours in harmony with their proximate cause, the circulation of progene, which systematically changes its activity according to the vitality of both kingdoms, but principally that of the vegetable kingdom, whose changes are in correlation first with the position of the sun and second with that of the moon.

The results most apparent to the senses arising from the perturbation of atmospheric pressure, are the movements of the two principal fluids distributed around the earth—air and water; but the more noticeable of the two are the ebb and flow of the waters as manifested in tides, the progenic pressure being greater where there are ebb tides or low water and less where there are flood tides or high water. But these motions of great masses of water may also vary according to other circumstances, principally from the difficulty encountered in passing through narrow channels (as in the Mediterranean), and also with the rotation of the earth, which produces a centrifugal influence which affects the movement of the waters.

Modern writers on Physics have already explained the action of gravity by means of imponderable ether (progene), but their theory is not complete because no explanation has ever been given as to how the circuit of the current in the system is closed; it was either left open altogether, or in some cases there was a pretence of closing it, but in an incorrect manner, and consequently the problem was not resolved at all. Some physicists are opposed to the ethereal explanation of gravity, and have based their opposition on worthless objections. They say that no analogy can be established between gravity and the other forms of action which are referred to propagations of imponderable ether, that is, progenic propagation, as sound, light, radiating heat and electricity, because these are transmitted with determined velocity in opposition to gravity which is instantaneous. In addition to this, they pretend to find many other essential differences which are not real; they say that gravity is a rectilineal and fixed or invariable force for all bodies, that it is inexhaustible, that it cannot be neutralized, that it is independent of the nature, volume, and structure of bodies, that it cannot be interrupted, reflected, refracted, or combined, and finally, that it only differs in a ratio proportional to the quantity of mass and to the distances among the bodies in attraction.

To these objections we reply in a few words which will suffice to convince us of their untenable character. We have already said in the theory of light that the propagation of movement through interstellar progene must be considered instantaneous, and that the defined velocity of a progenic course depends on the resistance of corpuscular or ponderable matter, from which interaction the transference of photothermic radiation into gravity results. Light passing through bodies has a definite velocity, because progene is not continuous in them, but distributed in parcels which are in a constant rotatory oscillation, not primordial, but produced by their collision with the particles which limit the interstitial porocules. Therefore, there is no reason for supposing any difference of velocity between gravity and all the other forms of progenic propagation. It is true that gravity is rectilineal and inexhaustible, but so also is light; it is not true that gravity is invariable, because its direction varies in different points, and it is also variable in intensity, which may be prov[illegible]ed by barometric changes; neither is it independent from the nature, structure, volume, etc., of bodies, as bodies lighter than the air are raised in that medium by the action of gravity; and, finally, gravity may become a factor or component of a resultant force as we see in chemical metamorphoses.

The effects of gravity, that is, of atmospheric pressure within the earth, are extraordinary; but not all subterranean changes are produced by gravity, as electric currents passing through the earth greatly contribute to cause such effects. The hypothesis supported by most geologists is that in the interior of the earth heat exists which has been accumulated since its formation, and such heat is generally considered the prime cause of all subterranean phenomena. It is a fact that the earth preserves the same temperature at the depth of 28 metres (about 100 feet); from that depth (where the thermometer always registers 12° centigrade), the temperature increases in a uniform progression of one degree for every 30 metres of descent (in round numbers 100 feet), and it is a mathematical conclusion that at such a rate of increase the heat must be sufficient to melt rocks at the depth of 100 kilometres (about 60 miles). Such an increase of temperature is principally produced by the transference of gravity into oscillatory movements of progene. Gravitating pressure is greater within the earth than on its surface, because the increase is in proportion to the square of the distance from the surface; the compression of subterranean bodies then is greater according to their depth, and this is sufficient cause for the high temperature which exists in the innermost part of the earth. Moreover, we repeat that progenic currents passing through the earth are partly transferred into heat, thus increasing the temperature. Hence, the heat within the earth is not primordial; it is derived like any other manifested change of nature; it is only a proximate cause of subterranean storms; it produces dilatation of bodies, changes of state and chemical metamorphoses, all of which may produce either discharges of progene as in simple earthquakes, or the escape of fluid and solid matters through perforations they make in the solid crust of the earth, in this manner volcanoes being formed.

Finally, once we admit the fluidity of matter within the earth, we must make our inferences according to the results of fluid pressures, that is, that the action of gravity is equally distributed throughout all the interior mass which is composed of liquids and gases, accompanied, of course, by the corresponding progene.

Static laws or those of the equilibrium of bodies are derived from dynamic laws; thus, although the effects of gravity are apparently manifested as repose and movement, the cause is always dynamic, for they result from progenic movements, and in order to perceive gravitating movements, falling of bodies (except in the case of falling meteors), it was formerly necessary to employ a quantity of living force in order to elevate the bodies in a direction contrary to that of gravity. Accordingly there is a constant neutralization in the world between living or manifested forces and gravity, when bodies do not exactly follow a direction towards the centre of the earth.

§ 54. THEORY OF THE PLANETARY MOVEMENTS OF THE EARTH AND TERRESTRIAL MAGNETISM.

The diurnal and annual movements of our planet are known only by reason, for our irreflexive sensations refer such movements to the celestial bodies; but since the time of Galileo they have been admitted and recognized as movements of the earth, so proving that the senses are deceived by the phenomenon called aberration of sight.

It is inexact to say that the planets are animated by forces, and the error is twofold when it is said that the planetary forces are two, one instantaneous and the other continuous. This last, astronomers say, is the force of interplanetary attraction, and the former they suppose to have existed only at the moment when the celestial bodies were set in motion, adding that the impulsive effect of such a force still persists by virtue of the inertia of matter. This explanation is fully contradicted by the fundamental principle of mechanism—conservation of energy—which in other words is the indisputable law of inertia.

The earth, as a whole, is in translatory divergent movement following the direction of an ellipse, and it is at the same time in spheroidal rotation; the first movement is called orbital and the second rotatory. The orbital movement is that which the earth follows around the sun, but at a great distance from it, closing the curve every year; this movement therefore being annually repeated. The rotatory movement is the daily movement of the earth on its axis, this being an imaginary line passing through the earth's centre from north to south, and on which it is supposed to rotate.

Both movements depend on the same cause, this is, the generating power of living matter by which imponderable matter first and ponderable matter afterwards are constantly disturbed, progene thus becoming the primary effect of material circulation throughout the universe.

Let us now clearly and precisely determine the movements of progene, which are the origin of the total movements of the earth. For this purpose it will be sufficient for us to know the great influence of sunshine on green vegetation, without the necessity of taking into consideration either the other planets, or the stars of other systems, as these only act in the modality of the change, but not as determining causes. In order to understand more thoroughly the production of the total movements of the earth by self propulsion instead of by mutual and distant attractions, let us imagine it in a moment of repose, that is, in a fixed position in relation with the sun, one half illuminated (day), and the other half in shade (night). The rays of light are translatory progene which is absorbed by the chlorophyl of the green plants. The moment progene is condensed by plants in a quantity sufficient to destroy the combinational resistance of the elements of carbonic acid and water, a great elimination of *oxygen* takes place, but some part remains in the plant with the *carbon*, and these two elements combined with *hydrogen* form new compounds called hydro-carburates; these ternary principles afterwards combine with nitrogen and thus form nitro-carburates. These combinations are not permanent; in the act of disassimilation from organism they are decomposed by gradual oxidation for which the absorption of oxygen and the elimination of progene are necessary. This oxidation is the predominant metamorphosis of animals during day and night, though it is more exaggerated during the sleeping hours, which are generally in the night; the metamorphoses of organic composition are predominant in the vegetable kingdom during the day, principally in those parts containing a great quantity of chlorophyl. Light, too, is an affluent stimulus for the formation of the carburates before mentioned, and although oxidation or interstitial respiration is constant in the vegetable as well as in the animal kingdom, it is not externally manifested in green plants during the day because the products of oxidation are taken by the plant itself to supply its great combinational necessity instead of being interchanged with the external medium. The chief consequence of these transferences determined by vitality is the propulsion of the earth by the circulating progene in two different directions, whose resultant, according to the laws of molar mechanics, is a double divergent movement, rotatory and parabolic. The forces in reference are, first, a propulsion in the direction of the sunlight produced by the absorption of progene which presupposes transference into ponderable motion; and, second, a propulsion in an almost contrary direction, produced by the escape of progene from all the organisms existing in the shaded hemisphere. That is to say, in the illuminated hemisphere the oxidation does not compensate the changes of organic composition, while in the shaded hemisphere the oxidation predominates, and it may be practically said that vitality during the night only produces the final result of organic combustion by the effect of which progene is freed and escapes into the atmosphere which is deficient in it, because during the night it does not directly receive any from solar reflexion. The propulsion of progene must be greater where the oxidation is most active, and this occurs in that part of the shaded hemisphere which is the last to receive the sunlight. Accordingly, this force of the night current is produced in a manner similar to the movement of a rocket, that is, by discharge of progene. Such a current propels the earth in a direction opposite to the point where the progene escapes, as when water running from a pipe produces a pressure in a direction contrary to that in which it flows. Of course, the explanation of the elliptical form of the terrestrial orbit, and the alternating position of the earth changing every six months from its aphelion to its perihelion is also based on the periodicity of vegetable life. There is no doubt that the cause of the elliptical revolution of the earth is the evolution of vegetable life, because when the total amount of vegetative assimilation on the earth increases, the day or light propulsion predominates, the effect of the absorption of progene being then stronger; then the earth is separated from the sun until the power of the sun's rays, diminishing with the distance, is compensated or equilibrated by the night currents. When the total amount of vegetable assimilation decreases and the night or escaping propulsion predominates, the effect of the absorption of progene becomes weaker, and then the earth again approaches the sun until the rays of light become very powerful (as they increase in strength in proportion to proximity) and can compensate the night propulsion. The succession of such changes naturally occurs every six months.

The position of the earth's axis in relation to the sun is also an effect of the periodical function of vegetation, which is not equally exuberant at the same time in all parts of the earth, the progenic propulsion being always greater in those places where the activity of the vegetable kingdom is greatest.

We have already explained three phenomena which are manifested as permanent molar movements of the earth; one, gravity which is partial in its manifestations, and the two others rotatory and orbital, which are movements of the whole earth. Another molar movement, partial like gravity, is also constantly manifested by the direction of the magnetic needle towards the poles. The constant disturbance produced by vitality on the surfaçe of the earth determines some other currents of progene (besides those before mentioned) which, as Ampere said, convert the terrestrial globe into a large magnetic ellipsoid. The most important of these currents flows towards the poles from a neutral line in the equatorial regions, which is called the magnetic meridian. This meridian does not coincide with the equatorial line, it is inclined to the northern hemisphere, as there land, and therefore vegetation, predominates over that of the southern hemisphere. This current, which may be called the polar current, depends, as we have already said, on the difference of the vital process between the life of the polar regions, where animals almost alone exist, and that of the equatorial regions, where vegetation, and, consequently, chlorophyl is more abundant. There is still another cause for the deficiency of progene in the polar regions: the light there acts with less intensity, and consequently the direct supply of progene from the sun is smaller. Between these two causes such a lack of progene in the polar regions is sometimes produced that the polar rrents become luminous, the aurora borealis and milar peculiar luminous phenomena thus originating.

§ 55. RECAPITULATION OF THE CONCEPT OF PLANETARY BODIES.

All the changes of the world may be divided into wo groups, phenomenal or manifested, and potential r latent. There are two kinds of phenomenal changes, total and partial; in the former we see the movements of bodies, while in the latter the movements are recognized only by the intelligence which refers them either to the two constituents of bodies—molecules and progene, or to progene alone. From this arises our distinction between molecular and progenic phenomena, each comprising two kinds, which, with molar movements, gives us five kinds of natural phenomena. Furthermore, we have already mentioned another kind of change which we have denominated potential, and this gives us the sixth material change, as shown in the following correlative order:—

1. Molar phenomena: visible movements and equilirium of bodies.

2. Thermic phenomena: changes of temperature nd of physical state.

3. Chemical phenomena: metamorphoses in the omposition of bodies.

4. Acoustic phenomena: oscillatory movement of rogene.

5. Optic phenomena: photothermic emission of rogene.

6. Potential changes: electricity, latent and radiating eat.

Putting these changes together, we form the concept of the motion throughout the world, establishing a very remarkable difference among the three kinds of physical changes, as in molar phenomena the body changes its place in totality, although it may or may not change the relative disposition of its corpuscular and progenic constituents; in molecular phenomena there is a change of place in the minute corpuscles of bodies, and therefore a change in the two corporeal constituents without any total movement; and in progenic changes (phenomenal and potential) the motion is in progene alone apart from molar or molecular movement. All these changes must necessarily take place in planetary bodies. Bear in mind that the distinction in physiological changes between propagations and transferences is relative, as in fact all material change consists simply in propagation of movement, and never in a true transference, but the propagation may be either homologous or heterologous, that is, without or with change in the form of movement, and from this arises our relative distinction between simple propagations (homologous changes) and transferences (heterologous propagations). The most remarkable thing in transferences is that the intermediate change is not ordinarily manifested, almost all taking place in the organic and inorganic world by means of potential transmission. Thus the conversion of molar movement into heat, of this into chemical action, and of molecular phenomena into progenic changes, and *vice versâ*, always need in other worlds as well as in ours the intermediate action of progene. There can only be a direct conversion when there is a transference of molecular change into molar movement, as occurs in the transference of heat, or of the movements of physical state, or of chemical reaction into utile molar work or into dangerous explosion ; and this kind of transference is produced in order to determine planetary movements.

In a final analysis all the changes of the world, including all functions of organic bodies, are reduced to the different kinds of propagation of movement which have been comprehended in "Analytic Physiology." We must not forget that mental activity must be separated from the synthetic concept of vitality in which there is only that which is properly organic. Viewed from an etiological standpoint, vitality has a very important natural condition, as it is the first effect or immediate consequence of the true cause of mechanical order in the cosmic system, that is to say, it is the first operation of the sole causal law through which the direct purpose or immediate aim of the Creator is effected. But circumscribing ourselves to the limits of material nature, vitality is the object of our study only in the succession of potential and phenomenal effects, *i.e.* in the functions of living bodies.

By the generating activity of living matter a current of progene is formed whose circle is complete ; progene in such a course interacts with ponderable matter, and from this interaction four constant forms of molar change result : gravity, orbital and rotatory movements of the earth, and terrestrial magnetism. In order to convey more clearly an idea of the complete circulation of progene, we may compare it to the circulation of the blood, and in accordance with this parallel divide it into a greater and lesser circulation, and the greater may be subdivided into afferent, efferent, and communicating currents. The heart being represented by the living world, and the great capillary net by the ocean of interstellar progene (communicating current), we have then this parallel: progene flows towards the illuminated hemisphere from the sun (afferent current), passes round (effect of the rotation of the earth) to the shaded hemisphere, where by oxidation it is set at liberty (efferent current), and irradiated through the atmosphere to the great ocean of progene until it collides with the bodies which constitute the ideal dome, and is newly reflected back by them to our planetary system in which there is a great focus—the sun—for the confluence of all planetary emissions. From this we must infer that the same change which takes place in the earth takes place in a greater or less degree in all the planets, and as the intensity of radiation decreases with the distance from the sun, the focus of all the planetary orbits is the point where the sum of all radiations is greatest; and in addition to this we must take into consideration the immense extension of the sun's reflecting surface, and also its emissive surface, which cannot be a small one. Accordingly, the rotatory and translatory movements of planets and satellites, and the rotatory movement of the sun are produced by progenic currents which are principally the effects of contrary reaction in vegetation during the day and night. All planetary bodies radiate heat as a necessary emission from the organisms existing on them, but the radiation becomes luminous by the confluence or combination of many thermic radiations in a sphere so vast in extension as the sun. Light also may result as the direct effect of very active combustion, as in comets, but this is a rare, and not the ordinary manner of its production.

All the phenomena of "universal attraction," or, better to say, *atomic gravitation*, have their rational xplanation in physiological synthesis as resultants of rganic movements or vitality. We have explained errestrial magnetism in the same way as gravity, planeary movements, and chemical metamorphoses, all of vhich may be comprehended under one denomination, s *magnetism* for instance, differentiating its modalities y prefixing certain words. In this manner magnetism hould then mean all the states of ponderable matter directly produced by the transference of translatory movement of progene, and *molecular magnetism* may be substituted for the phrases atomic and molecular attractions. Cohesion and affinity have been explained in the theories of Heat and Chemistry by the intermotion of molecular gravity with progenic oscillation, and we now add that the result is a true molecular magnetism, which may be in a state of equilibrium or of movement, the former resulting when the centrifugal force of heat and the centripetal one of gravity are equal, and the latter when one of the two predominates.

Thus the harmony in the world is perfect; the progenic currents are the sole agent of magnetic phenomena; they move the molecules to their chemical metamorphoses, and are also the occult motor of the immense masses of the planetary systems. That is to say, planetary movements and those of molecules in chemical changes are produced in the same manner as the magnetic movements of the earth; all three result rom the transference of the currents of progene into ranslatory movement of ponderable matter.

CHAPTER VIII.

CONCEPT OF THE UNIVERSE.

§ 56. Is the universe an organism or a mechanism?—§ 57. All objects in the universe qualitatively identical—§ 58. Propagation of movement throughout the universe—§ 59. General criticism of the doctrines of evolution—§ 60. Additional argument against transformism—§ 61. The doctrine of Cosmogony is not physiologic—§ 62. Causal determination of the universe—§ 63. Recapitulation of the concept of the universe.

§ 56. IS THE UNIVERSE AN ORGANISM OR A MECHANISM?

In the dispute regarding the question as to whether the universe is an organism or a mechanism, the terms are not set forth by the majority of writers exactly as they should be defined. Most authors, especially those circumscribed to Physiological Sciences, have no clear and complete idea of the concept of mechanism, as they affirm its exclusive existence, comprehending in it the whole cosmos; while most philosophers, speculators of the mind and of the divinity, proclaim the great truth—the necessity of the organic conception of the universe, and therefore the existence of an organizer. The universe, properly interpreted, is in principle an organism, but such an affirmation does not exclude the real existence of mechanism, if this is limited to explain the effects of physical cosmos, objective things or material nature. And for this reason great success has recently been experienced in Physiological Science upon the sole basis of mechanical theory, but such progress has been erroneously interpreted by most physicists, who have fallen into materialism, confounding what is purely phenomenal, that is, the description of the effected form of objects, with the cause itself, so identifying their ideas with positivism, protesting against the possibility of our intelligence acquiring any other knowledge than that given by phenomena and their laws, without admitting the existence of a Primordial Cause.

Physiological Theory has demonstrated the essential necessity of unity in nature, and certainly a system cannot be constructed of independent parts without mutual relations of principle and aim; the whole universe cannot be explained by a casual sum or aggregation, but by causal union of the parts. Such a cause must necessarily be a supernatural, supreme intelligence which must be conscious; an unconscious intelligence is an impossibility, as the terms are in plain contradiction. The unconscious intelligences interposed as immediate agents of nature, like the vital principle or force admitted by vitalism, are fantastic, incomprehensible things, because our mind contains but two kinds of perceptible notions, that of our own consciousness and that of matter; by the first, whose data are qualitative perceptions intrinsic to the mind, we infer the knowledge of the immaterial or supernatural (soul and God), and by the material notion, whose data are quantitative perceptions extrinsic to the mind, we acquire the knowledge of physical nature —material object or mechanism, composed of ponderable and imponderable matter. The material concept is different from but not opposed to the mental one, and our understanding excludes from reality, and considers as nothing, or simply as names of imaginary things, all which is not one of the two—either intelligent cause or mechanical effect. Furthermore, mechanism is determined in accordance with the supreme idea or law which, like its dictator, can only be good with absolute perfection, and then it must be one and invariable; this is confirmed by the uniformity or constant regularity of nature, and by the truth of the mechanical laws which, being derived from the divine idea by means of its engendering influence upon living bodies, are never capricious or irregular. Accordingly, Physiological Theory recognizes the mechanical laws acquired by rational experience, and yet, while it admits the truths of Mechanics, it also admits the existence of the True Cause, because, if mechanical ideas are considered independent of a cause, we should affirm the abstraction of effects without cause, and then we would be obliged to refer ourselves not to the complete system, but to the object of physiological science alone, that is, to the redistribution of matter in movement, and this does not embrace all which exists in the universe.

Our division of theoretical or philosophic sciences into Physiology and Metaphysics removes the traditional opposition between physicists and metaphysicians, each having a very well-defined province. Metaphysical explanations go beyond what nature offers to sensual experience, that is, what is not within the reach of our senses, and cannot be inferred from sensual data but by pure reason; this is the reference of things and changes to the Prime Cause interpreting the end of manifested activities. Physiological or physical explanations teach in what manner a definite state of things results from another state which is its antecedent in accordance with general laws, or, in other words, the properties of a compound depend on those of its components; but physical explanations must implicitly assume the total system, although expressly considering only its mechanical laws without any attempt to interpret them, or to inquire which is the beginning or which is the end. Therefore, if a mechanical law is taken as a basis of Physiology, it always implies the existence of the author of the law. The physicist must follow the advice of the metaphysician in order to correct his errors in the fundamental concepts of nature (matter and force, mass and movement, protoplasm and irritability, etc.), instead of denying or treating such advice with disdain, as most of them do; and, on the other hand, the metaphysician must gather physiological knowledge in order to guide his ideas by the natural facts which are the sensual fruit of the activity of the Creator.

All manifested changes have a common origin; organic generation is the causal determination of phenomena in all material aggregates, whether living or not, and this common character is discovered by our Physiological Theory. Starting from this fundamental distinction between living and non-living bodies, we affirm that in the connection with the Primordial Cause or Creating Activity only organic generation is under its direct and continuous influence, and so we can then understand the relative validity of mechanical laws in the universal system. Such laws are only a complement or contribution to the notion of the universe in which unity presides over the beginning and the end of all things. Our task is not to establish the proofs of such an affirmation; but we declare such a truth in order to put ourselves in opposition to pure mechanical ideas, and to exclusive atomism, which try to explain all the system merely by the accumulation of material elements, every one independent of the system, supposing activity is all inherent to matter or to atoms.

The universe cannot be explained by mechanism in its primordial effects—creation and organic generation—so that the concept of mechanism, excluding causal determination, assumes but a partial system of nature, comprehending in the signification of this word that which is manifested and inferred from the data of extrinsic experience; in this sense Mechanics and Physiology are synonymous, and their final aim is only to discover the laws of mutual connection of the phenomena within the derived effects of the universal system. Mechanic explanations, then, do not go beyond organic generation, a fact that cannot be explained without having recourse to something outside of mechanism, while by mechanism itself we can clearly account for all the other facts in which we do not need to refer directly to the true cause of the universe.

Accordingly, Physiology, including Molar Mechanics, Physics, Chemistry, and Biology, is a science altogether mechanical, but the mechanical ideas are limited to the assumption of the partial cosmic system with its material changes and laws alone, so that a physiological explanation consists in teaching how a derived or secondary effect is produced, leaving us nothing as to the Primordial Cause and effect save the belief that there is a purpose in the process, as the integrity of cosmic mechanism in its actual state consists not only in the continuity of movement, but also in the natural dependence among the members or parts of the system which are all under the same general laws.

§ 57. ALL OBJECTS IN THE UNIVERSE QUALITATIVELY IDENTICAL.

We have affirmed in the Analysis of Cosmos that matter is everywhere equal in its attributive conditions or qualities ; that all objects are of the same substance (which differs only in numerical or geometrical proportions), and of the same form of activity, which is always movement, and which is propagated with conservation of energy. We now add some explanation in order to give such a proposition its universal concept, extending it to organic as well as to inorganic bodies, to celestial as well as to terrestrial ones. For this we need only apply the arguments given on the abstract concept of matter to the concrete aggregation of all the objects constituting material cosmos.

The substantial identity of all objects of the universe is a question beyond practical resolution, since by experience we cannot transform all objects into one and the same chemical element ; but the character of this question is not purely descriptive ; it is genesic, and as such it is not a matter of the senses but of reason ; consulting this, we know that the propagations through the senses and nerves cannot be propagations of different quality but only of quantity, because the object does not touch the centres where the proximate change to the presentation of ideas is produced, and therefore that qualitative differences, when they make reference to objects, depend on the reactions provoked in the mind by the propagating movements which vary only quantitative relations. If there could be differenc quality among matters, [illegible] they could not revealed by our perceptions, so that the referenc qualities to objects is a consequence of our ignora as in order to know the object completely we m discover the quantitative relations of all its chang explaining in this manner all their analogies and di ences. We repeat that the perceptions of the quali only give us the knowledge of the mental subject, they connote its power or capacity of objective rep sentation.

Hence all objective properties consist in relati differences resulting from the different collocation redistribution of matter in movement; and althoug such identity of quality among all the constitue of the universe cannot be affirmed as an irreflexive fac it is a principle of thought inferred from experimenta limits, as the data of sensual observation can never pass from the determination of relative or quantitative laws.

Most physicists explain material or objective interaction by forces acting between things and producing their sensual effects; thus they explain action at a distance by the empty phrase "universal attraction," which, according to their view, must be a force o omnipotent and omnipresent power, as it can act throug void spaces and through interposed objects; they explain calorific changes by an equally empty phras "repulsive force," which they suppose is originated b an inherent elasticity in imponderable ether. If thi really constituted cosmic mechanism our proposition c the attributive identity of all objects would be erroneou because the existence of such opposite forces of attrac tion and repulsion would denote the existence of some essential quality inherent to the peculiar nature of every kind of matter. But we know already that physical forces are nothing more than names for mental abstractions, and being only ideal names they cannot explain anything ; and on the other hand, even if forces were really things, the question would still remain unresolved, as we cannot say what things really are. We must deny that objects act by the effect of forces, and consequently to say that the particles of a body or different bodies are united by their attractions is only to describe a fact, and, what is still worse, to describe it in improper terms, because matter cannot be attracted as if its different portions were drawn together by inflexible cords. The sole material reality is in the objective things themselves, and there is nothing else among them ; they are not independent, but under the law of the director of universal organism.

We repeat that the mind needs the constant attention and guide of reason in order not to be deceived by the abstract signification of some words and mistake them as representing realities, as, for instance, when we speak of mass and movement in Mechanics we must not think that they are independent things of different qualities ; movement simply represents the abstract idea of the points where an object may be successively changing its place, and with such points we can draw a continuous line which marks the course of the object. There is nothing attributive to the thing itself, for we suppose it in movement ; the differences between an object in relative repose and in movement are differences of reason, marking either simply the relation in space, that is, the direction, or the compound relation of space and time called velocity, which is the peculiar or characteristic measure of movement, and which is determined by the space run over in the unity of time (a second).

When movement is variable (as is always the case in nature) the velocity is determined, supposing that the movement is uniform, the moment we try to determine it; this implies that movement is completely different from its determination or measure, as velocity does not exactly fix the intimate condition of what is impelling the body to move with greater or less intensity in order to change the place or position of objects. We make the same arguments in regard to every one of the terms and properties of objects as they are all relative, *their differences being only quantitative.* But we cannot be too careful in closely analyzing the complex concepts of most of the terms in order to see which of the elemental concepts are comprehended; thus, for instance, mass represents the quantity of ponderable matter which is measured by the action of gravity, and gravity is a resultant of the intermotion of atoms and progene in movement. Therefore the concept of mass comprehends in itself the two attributive elements, substance and activity. In addition to this, in a concrete sense, mass is not a fixed relation, but on the contrary varies according to the conditions of space and time.

This is enough to prove our proposition, which in other words affirms that when language expresses a qualitative difference among objective things it is always in a figurative sense, either connoting a direct reference to mind according to irreflexive or sensual appearances, or representing simply by abstract nouns the conceptual ideas we form from objects. In the former case language has given rise to the fallacy of sensation in which the representations of the mind are taken as objective differences, and in the latter a fallacy of thought is produced, taking concepts as objective realities. Accordingly, we must conclude that *all objective natural or material differences must be referred in reality to quantitative relations.*

§ 58 PROPAGATION OF MOVEMENT THROUGHOUT THE UNIVERSE.

Irreflexive appearances of sensation have engendered in human understanding the abortive concept of absolute repose, considering it as primordial and in correlation with the ontological idea of movement, considering this movement as a thing merely originated in the world. The signification of the terms absolute repose and absolute movement are irreflexive and not intelligible, because we can only comprehend objective change as produced by propagation of movement, a finite or partial system of things passing, for instance, from a state of relative repose, in which the distances among those things are preserved, to a state of relative movement in which the things do not preserve the same position among themselves, and then a correlative equivalent change, but of a completely opposite order must be produced in the other material things.

If the limit of physiological explanations is in the knowledge of the correlation of material changes, the primordial origin or generation of movement is inexplicable as is that of matter; besides generation of movement is inseparable from creation of matter, as we cannot start from the supposition of considering it as primordially passive. Hence neither has repose preceded movement nor movement repose; they are only two relative conditions of objective reality, differentiated by the sensual states of the relative ideal division that we make of the circulating system of nature into smaller or larger sections, which generally represent only a very small part of the whole.

If movement is only a condition of objective things it cannot be transferred. Speaking with propriety, it can only be propagated. Nothing can transfer its own movement; an object can produce an equivalent movement in another object, and then the antecedent movement disappears for the sensation, but the resulting movement is not truly generated, it has only appeared either under a different form or in a different place.

In the propagation of movement the fundamental law of mechanism—conservation of energy—is admitted, but although this is a true principle, many physicists have drawn from it deductions which are totally different from its enunciation, and it has consequently been considered as the basis for the false dogma of the kinetic hypothesis that movement in the phenomenal state is constantly the same, and that therefore it is something inherent in matter with the perpetual condition of continuing manifested in the same quantity. It is mathematically demonstrated that movement does not persist in the same quantity in bodies, because the continuity in the change of movement through ponderable matter is lost or constantly neutralized by gravity; the movement then is returned to its potential uniformity, and as this is a progenic energy, and progene can pass from one body into another, the movement or energy of all bodies varies. Therefore there is a tendency to repose in ponderable matter, not through its own agency but through gravity. We have seen that, in order to explain the loss of living force in mechanism, the upholders of the kinetic hypothesis have considered elasticity as an inherent property of matter, having the power of restoring the loss of living energy and therefore of generating movement. This, as we have already explained, is not only an imaginary conception but one contradictory both to the fundamental idea of their hypothesis and to the undoubted condition of inertia of matter. We have also explained that manifested changes are engendered in living beings, and for these a variable movement must be precisely originated for the collocation of the elements necessary for the formation of organic structures. Such a movement, which restores the loss of living force in the world, is certainly not a new creation; it is a propagation superior to the power of mechanism, as a variable movement has been produced by a uniform potential energy thus converting it into manifested changes or phenomena. In this manner we have explained the mutual connection in the system between multiplication of living beings and that called multiplication of living force, which regenerates manifested changes or phenomenal evolution.

Although all these questions now enunciated have been separately considered before, we must bring them together here in order to explain clearly the causal determination of movement.

Energy is the capacity, whether manifested or otherwise, to produce a movement, that is to say, the force to change the relative position of an object either in its totality or in its constituents—atoms and progene. The mechanical principle of conservation affirms that there is always the same quantity of energy in the universe, but the word "energy" in this comprehensive sense does not alone represent the quantity of molar and molecular movements, whose measure is half the product of the mass and the square of the velocity; in energy is also comprehended progenic movements, either phenomenal or potential. For this reason we cannot consider as a logical consequence the affirmation of the physicists that the quantity of movement of two bodies cannot be increased or diminished by their collision; that the sum of the product of the mass of the bodies and half the square of the velocity are the same after as before the collision. They say that the translatory movement of bodies is then converted into a vibratory movement of their particles, from this arising an erroneous corollary of the principle of conservation of energy by which they affirm that movement is inherent in bodies, these always preserving the same energy though changing the form of the movement. In order to maintain such a fallacy, these authors claim to be assisted by the results of experience, affirming that such a conversion of energy into vibratory movement of the bodies in collision is palpably seen if we experiment with elastic bodies; and, they add, in those cases in which there appears to be a complete loss of energy, as in the collision of soft bodies, it is because all molar movement has been converted into molecular. We have already seen that the true facts of experience are contrary to such imaginary ideas, as there is not even one case of conservation of energy in bodies after their collision, because there is no such thing as perfect elasticity in bodies; and even if we take into account the translatory movement which in a collision is transformed into potential forms of energy, we constantly find the loss of living energy and the propagation of some movement from within the bodies in collision to other bodies; and in the same manner we may affirm that the movements of ponderable matter, either of masses or of particles, constantly lose some energy after any manifested change, on account of the passive resistance determined by gravitation. This constant neutralization of mechanical energy in the world accounts for the notable differences between such abstract ideas of Mechanics as those now mentioned and the practical facts of real cosmic mechanism.

Propagation of movement throughout progene alone, as in interstellar spaces, is constantly preserved with the same energy, because, the density of the metafluid being the same, there is no cause for passive resistance as there is in bodies whose atoms are of almost twice the density of progene. From such uniformity in the interstellar fluid arises the perfect persistency or continuity of planetary movements in harmony with some determined law, and in opposition to this is the fault of persistency or continuity in the movement of the constituent bodies of our planet, the problem of continuous movement being for this reason of impossible resolution in our industries. Therefore, if we apply the calculations of Astronomy to the movements of terrestrial bodies, we must take into account the differences between the mediums, and consequently the law of gravity.

The law of gravity is precisely our proof to demonstrate the difference of condensation between ponderable and imponderable matter as well as the equal condensation of all atoms, because the influence of progene upon ponderable matter in a tube from which the air has been exhausted is equal for all bodies. From this we deduce the fact that progenic pressure upon the earth determines in all bodies a force proportional to the quantity of ponderable matter which they contain—mass, and the measure of such force is the weight of the body. This explanation of terrestrial gravity shows us that although mass and weight have been considered in ordinary Mechanics as passive resistance, they really represent activity, as they are the effect of an invisible movement determined by the constant pressure of progene in a centripetal direction, that is, towards the centre of the earth. This pressure is also the cause of the necessity of employing a force proportional to the mass of bodies in order to elevate them to the same height, that is, moving them to the same distance in a direction opposite to that of gravity.

The influence of gravity which is palpably observed in molar movements is sufficient to lead us to infer its general application to the propagation of movement throughout the invisible particles which by their aggregation form masses. Thus, for instance, a chemical combination takes place because the equilibrium of progenic impulses is re-established in accordance with the greatest neutralization of forces which represent the measure of the oscillating energy of interstitial progene on the one hand and the atomic resistance to the pressure of gravitating progene on the other, so that we must not forget, in invisible movements like these, the constant effects of gravitation, which produce a loss of living force in every corporeal change.

Accordingly, we have made two limitations in the principle of conservation of energy, as we have demonstrated on the one hand that there is always loss of living force in intraplanetary actions, and that such conservation may occur only in interstellar propagations, and on the other hand that the whole universe is not a definite mechanical system to which the mathematical formulæ of the correlation of forces can be applied, as in our investigations we finally reach a point which is not mechanic—this is the generation of vegetable and animal organisms which work under a power of collocation, the reparation of the loss of living force being also due to this.

Many biologists affirm that vital functions result from physical and chemical phenomena, which are nothing but changes of movement among constant and uniform elements. But there is a fallacy in this affirmation; it consists in taking as resultant that which is identical; and there is also an error of irreflexive observation, because in the acquisition of the ideas which explain phenomena we first refer in the development of our mind to inorganic bodies and afterwards to the organized. Vitality does not result from physico-chemical changes, though phenomenally considered it is only a synthesis of all physiological changes which are primarily recognized and studied in the inorganic world; from this fact has resulted the erroneous concept of affirming such a succession in the acquisition of ideas as the natural order in genesis. It is evident that every phenomenon or change manifested to the senses, whether the object referred to is organic or inorganic, supposes a change of movement, and therefore we may say that vital phenomena are physico-chemical changes like the inorganic, but this is not to say that the former *result* from the latter. If the word "result" means that the phenomena in organism are consecutive to those of inorganic bodies we then invert the natural order, because organic generation is the sole movement in nature that cannot be explained by the propagation of living energy like in mechanism, as, on the contrary, by life some force becomes manifest instead of being lost.

Thus we may maintain that the world is in uniform variable movement, as this is necessary for the constant and uniform changes of nature; that in any mechanical change occurring in bodies there is a loss of living force because the density of atoms is greater than that of progene; that from this difference atoms are always losing movement in their continuous intermotions with progene; and consequently that progene would reduce its variable movements to a state of invariable uniformity if it was not returned to a variable state by the act of organic generation.

§ 59. GENERAL CRITICISM ON THE DOCTRINES OF EVOLUTION.

The most important points in the genesis of natural evolution are: (1) the transformation of the different states of bodies; (2) the generation of chemical species; and (3) the generation of organic species. This last point, the origin of organic species, and that of mankind in particular, is reserved for Biology, because a general or comprehensive criticism of the evolution of all bodies will here serve our purpose to combat the false doctrines of evolution, especially that of modern transformism, and because the special criticism on the doctrine of evolution of living bodies belongs to the separate treatise we shall publish under the title of "Abstract Biology."

It is generally supposed that the solid state is the primordial one, and that the fluid (in its two forms, liquid and gaseous) is engendered by the dispersion of solid particles, liquids being thus first derived and gases afterwards. This manner of conceiving the evolution of the states of bodies, according to which the solid is considered as the prime material, is the fruit of irreflexive observation in which the sensations presented to the mind are not analyzed with reflection, thus lacking rational interpretation. The state of matter which has been primarily perceived by our minds is that which forms solid masses; thus humanity in its first age, and every individual in its infancy, has first taken notice of solid bodies, afterwards assimilating in perception and language the fluid states (liquids before gases) to the solid as things equally material, in the same manner as in the present day we assimilate the metafluid (although imponderable) with the different states of ponderable matter as being also material substance. The mind is predisposed to explain the order of the natural genesis of things by the order in the acquisition of ideas, and for this reason the mental construction of bodies has been generally reverse to that which reason discovers; but instead of beginning with solid particles which is the most complete state of chemical species, we must begin with the simplest state of matter—progene—which, condensed by a power superior to mechanism, has formed the indivisible particles called atoms; these, when dispersed or separated from one another, form gases; when they are in contiguity two by two they form liquids; and when all are in contiguity in some point they form solid bodies.

The erroneous belief of the priority of solid matter has engendered, as we have already seen, the erroneous concept of absolute atomism, which supposes that matter always consists of indivisible particles absolutely rigid and tangible, thus presenting the solid body not only as the typical but as the general form of the constitution of matter. But such an idea, we repeat, is opposed to rational experience, which directs us to assume expressly the contrary, that bodies in their gaseous state are comparatively the simplest, and that therefore the natural order of evolution is to go from the simple to the complex. But this argument has conduced one of the most notable thinkers, Laplace, to found another hypothesis affirming that the primitive or typical state of matter is the gaseous existing in a very subtile or rarefied form called "nebulus." Comparing the two mentioned hypotheses, we can at once estimate the great scientific superiority of the last, considering it as more rational than the first, but only as a descriptive means. In our judgment the hypothesis of atomism may be qualified as spontaneous or irreflexive, or, it may be said, puerile; and the doctrine of the nebulus is merely a graphic or descriptive illusion which is not worthy of elevation to the rank of a genesic theory of the universe as it is considered by almost all physicists and naturalists. In addition to this the hypothesis of nebulus has been the basis for the doctrine of transformism, which, as a theory of genesis, is altogether inadmissible. The existence of cosmos can be explained only by involution, this word meaning that natural existences have been created even in the most complex form—living species, and that the successive change of things consists in changes of physico-chemical states, but continuing in a circle returning to their former condition and state.

Nevertheless, the most plausible genesic explanation t present for most physicists is the hypothesis of nebulus, according to which all the forces of cosmic evolution are derived in final analysis purely and simply from the position of original gaseous particles uniformly diffused throughout space, and endowed with attractive and repulsive forces; they supposing that all changes of compound forms, organized as well as inorganic, must be referred to the chemical affinities of the original material elements. In this manner the upholders of this hypothesis fall into a chaos from which they cannot extricate themselves; they pretend that the system was formed only by its own tendency, denying in a more or less concealed manner and with vain words the intervention of the Creator in the successive changes of cosmos, leaving matter to make the evolution by itself alone.

This hypothesis marks the second step in intellectual development in the same manner as the idea of primordial solidity may be considered as the first step in mental perception; but there is a third step beyond physiological inquiries, to reach which is not within the capacity of all minds, though every one who attains it has the consciousness of the three stages: first, irreflexive experience, for which the explanation of absolute atomism is enough; second, rational perception of effects, for which a transformistic theory suffices; and third, the conception of the unity of the system, for which the admission of a Supernatural Generator is necessary. This last step must not be confounded with mysticism, which sees in the changes of nature the capricious and variable commands of a changeable Deity instead of the necessary and invariable connection between cause and effect, as is demonstrated by the uniformity of nature, which necessary belief is the universal postulate from which we can draw the fundamental principle of Physiology, with the assistance of the experimental facts of inertia of matter.

Although the complete knowledge of the universal system can never be reached through physiological studies, still every student of nature has tried to construct it mentally; but the base of the method has been always false, because each and all have tried to build the whole infinite of a finite part, selecting for this starting-point the concept which every one has judged to be the simplest. Thus, for instance, those who have examined only extrinsically have seen the origin of all things in some material substance like the earth, air, fire, water, hydrogen, helium, protile or imponderable ether; while others, whose studies are introspective, have taken as a genesic principle some ideal conception as love, friendship, discord, intelligence in general, and even personal reason in particular. Hence they have all supposed that which is the final result of the unification or generalization of their thoughts to be the principle of all existing things; that is to say, reasoning with material or ideal entities, once they have reached to the end of the process of abstraction they have converted the simplest or ultimate induction to which they have arrived into the generator of the whole, real or universal system.

Setting aside as unworthy of consideration those doctrines which pretend to take as a basis what is simply an abstract idea of our mental or psychical capacity, let us return to the criticism of the doctrines which explain the origin of the universe by objective or physiological characters from the material elements. We cannot comprehend a universal system compounded of chemical elements alone, because we would not be able to perceive the object if this existed without any change; then with the power of mechanism alone $r < f$ (manifested energy less than living force employed) all the activity of the material world would be reduced to a completely uniform movement of progene, and therefore no sensual manifestation of living force could exist. Our intelligence can comprehend a system only by admitting manifested changes simultaneously produced by generation of living force, $r > f$, and by its dissipation, $r < f$. The universe being in a variably uniform movement, needs some parts acting as generators of living force, while other parts act as dissipators, energy thus passing from the actual to the potential, and from the potential to the actual state.

The physiologist, then, has no data by which he can investigate the complete evolution of the universe, either in space or time; his limits are reduced to the interpretation of definite or material changes after the creation of the world in a state which can differentiate from the actual only in quantitative relations owing to the redistribution of matter in movement, and which relations can be calculated as mechanical transformations, that is, according to the formula $r = f/_2$. The potence which produces this change of organic generation acts, then, in a manner inexplicable by mechanism, not only because the resultant energy cannot be explained by the propagation of movement as in a machine, but also because we cannot refer the methodic and constant relations like those observed in organism to mere coincidences, but to a supreme necessity, and from this arises complete harmony in our physiological conception of the system. Physiological theory is justified in denying the independence of mechanism, because an aggregate of agents acting mutually is impossible; we must conceive the whole as dependent on a fundamental unity whose purpose or essence is at bottom the ground of nature and its laws.

To know what a thing is is not to know how the purpose of the same thing is effected, and the lack of knowledge of such a purpose must be always supplied by the study of the means in such a manner as not to destroy the belief in a causal principle. The negation of the principle of supreme unity arises only either in ignorant or in vainglorious minds which, because they presume to know how some changes are effected in nature, deny a determined purpose in them without other reason than that our limited intelligence cannot discover the final purpose or nature of the cause as it does the means or effects. We must admit the final purpose of universal activity in accordance with a supreme will, and in this we recognize, of course, a free intelligence not only as a creator, but as a generator of the phenomenal world or actual state of the object.

Nature is uniform in its evolution, because the finality of the Almighty cannot be conceived as imperfect or bad; His laws finally conduce to the greatest perfection and good in the material system, which consequently must be formed of combinations of actual necessity in accordance with the aim of the system, and not merely as coincidences or accidents of matter. Radical mechanism, on the contrary, conduces to the belief that the laws, order, and harmonic combinations of nature are merely coincidences of the elements without any relation to final effects.

We may sum up our ideas of the order of succession of the different changes which are produced in the circle of involution of nature as follows (starting from the mysterious effects of nature):—

1. *Protogenition*—a progenic change consisting in the generation of progenic currents necessary to move the atoms in order to determine organic combinations —generation or multiplication, and growth of living matter;

2. These combinations constitute *nutritive* or *trophic assimilation*, which consists in molecular or thermochemical changes of reduction;

3. *Biotension*—that is, the progenic latent energy which is accumulated in the organic combinations of reduction;

4. *Nutritive* or *trophic disassimilation*, which consists n molecular or thermochemical changes of oxidation y which the energy of the progene which was in ension may be used in the functions enumerated under nnervation.

5. *Innervation*—consisting in a progenic current hrough the nervous system which, in its characteristic hange, may be considered as the electricity of organisms, although the transmitting current is combined with thermochemical changes of the nervous elements;

6. *Contraction*, which consists in a return molar movement in which progenic energy is principally transferred nto muscular work;

7. *Reproduction*, which consists in a division and subivision of organic germs, in order to multiply either the arts or the whole of living individuals; and

8. *External changes* of organism with the cosmic medium, consisting in material transferences or propagations, either progenic or molecular, or else molar; in this manner also all the changes of the inorganic world are secondarily produced.

Therefore, all variation of movement in the inorganic world, and consequently phenomena, are secondarily derived, that is, consecutive to the organic movements, which in synthesis constitute the functions of vitality. Thus, progenic propagation, if continued in a diffuse, potential radiation, is radiating heat; if conducted in a confined manner through bodies, is electricity; if diffused, but interrupted, so that the emissions have sufficient celerity to impress the retina, is light; heat, electricity, and light, then, by their different interferences in bodies, occasion the molecular or thermochemical changes of the world, and afterwards, either directly or indirectly through molecular changes, all the molar movements are produced, the movements called magnetic and planetary included.

If the changes in the inorganic world are simple propagations of movement, produced by the operations of the organic world, and the former at the same time is a necessary medium for the latter, the living or manifested energy of the world could not last without both. Furthermore, the existence of the two kinds of organic material—coloured matter, principally green, as in vegetation, and colourless, as in most animal webs or tissues, is complementary, and without both life in the universe could not be possible, one principally producing the metamorphosis of reduction, and the other that of oxidation. Here we see once more the error of transformism, because the universe could never exist in evolution without living bodies, nor with vegetable life alone —its evolution, or, better to say, its involution needs the co-operation of the three kingdoms—mineral, vegetable, and animal.

§ 60. ADDITIONAL ARGUMENTS AGAINST TRANSFORMISM.

Can any one imagine a greater contradiction than the admission of a primordial state of matter perfectly uniform, affirming the truth of inertia of matter, and at the same time considering matter capable of changing by itself? Inertia necessarily presupposes the admission of causal activity in matter, and if this were the case, such activity, according to the order and harmony of the changes it promotes, reveals an intelligence, and then, according to this, matter is endowed with intelligence and not with inertia. In this manner naturalists of the materialistic school, in trying to deny true deism or monotheism, fall into polytheism, presuming with childish insistance that they can interpret universal evolution by the so-called inherent forces of matter alone. Consequently, those who uphold the transformistic doctrine of evolution so widespread to-day, must confess either that they don't want to say what they say, or that they do not know even how to place the problem of Primordial Cause, which is the supreme, unknown quantity of Metaphysics.

To endow matter with an inherent power of evolution and at the same time to consider it as inert involves contradictory and irreconcilable ideas; action as inherent to matter is then a contradiction to the principle of the conservation of energy, because this principle and the law of inertia are the same idea enunciated in different terms, both affirming that matter cannot change by itself, that is, that it could not produce any mutation by itself if all was primordially in a state of relative repose, or, better said, a completely uniform movement, and consequently that the movement or energy of the physical changes of the system can never result from the mutual action of the objective parts and particles among themselves.

The greater number of those who have occupied themselves in explaining cosmic evolution think that they can elaborate a theory of the origin, present state, and end of the universe, considering this as a something finite in time and space, and that they can scientifically determine its past and its future. Thus, transformism starts from the principle of an absolute nothing, and this non-existence is referred back some millions of years; the transformists suppose, in the beginning, a material state of absolute uniformity without any change, from which the phenomenal differences which are the essential conditions of physiological notions gradually arose. But if evolution is of itself an impossibility it would be equally impossible of occurrence "through many millions of years," and "through infinitesimal changes," under which expressions transformism lies hidden. This affirmation of a limited duration of the universe pretends to be founded upon physical considerations deduced from recent studies on planetary constitution, but this is nothing more than to confound the genesic principle with the descriptive method in which we begin by supposing that at first our mind is absolutely empty of knowledge and that knowledge is formed by a successive aggregation of material, until we give to the mental construction the greatest complexity to which we can arrive in our inquiries, giving to such a complexity the representation of the actual state of the universe, although this at present is in reality the state of the past and of the future. We must not confound the relative mutation of a limited system of things which is within our knowledge with the absolute mutations of the universal system which are unknowable; to affirm that which is inconceivable is too absurd a pretension to be given a place in science; nevertheless, the geological studies which transformism presents as proofs of its doctrine are considerations of this kind. This cosmogonic hypothesis, presuming that absolute determinations can be scientifically explained, either makes a grotesque description of the acts of the Creator in parallel with those of the human creature, supposing that Creator as the image and likeness of man who makes a work of art, and as first existing and thinking alone how to make a work of art, forming the whole from nothing, or, what is still worse, that without any Creator all which exists sprang from nothing, or, what is almost the same, from an eternal uniform state of matter in invariable movement.

The origin and end of the universe is to us an impenetrable mystery, and therefore we must never make it the subject of a scientific thesis on our physiological ground; we must circumscribe ourselves to the study of the relative changes of cosmos in the course of time, and not inquire about its principle and end. Nevertheless, the doctrine which affirms the limited duration of cosmos has also received the favourable opinion of many physicists who maintain that the limit of the future is determinable, because, they say, the mechanical energy of the universe is gradually lessening, since that which disappears does not seem to be restored in equal quantities; they affirm that a time will come in which the earth and the other planets will not be habitable, and that the energy will be finally lost as a proof of change, movement throughout the universe becoming again absolutely uniform. This conclusion, which pretends to be experimental, lacks foundation, because only a partial reference can be made to experience, as this cannot grasp the whole universe ; thus, such a reflection is made, of course, with limitation to our planet, which, being a part in mutual dependence with the other celestial bodies, must always change through interplanetary propagation, and therefore decrease of energy in this planet presupposes increase of energy in the indefinite cosmos. But they think that the changes of our planet could be extended to all cosmos, and in order to make this application easier they have imagined a universe definite not only in time but occupying a definite space. Thus, instead of simplifying matters, transformism has increased the difficulties of the conception of cosmos even without saving the contradiction of the terms *infinite* and *dissipation of energy.*

We must not forget that we refer ourselves to a physiological thesis, and that therefore all discussion must give us some positive knowledge ; and if we do not know how to determine the limits of the universe either in its substance, activity, space, or time, it is for us as illimited, as infinite, as is the determination of any relativity of existing things. And now we may add that in an illimited thing, as is the universe, it is as incomprehensible to us how energy can be dissipated as how it can be preserved the same ; but we have admitted conservation of energy as the fundamental principle of mechanism, because the fact of inertia of matter is undoubtedly true.

Once we have demonstrated the fallacy of the hypothesis of transformism in general, we might excuse ourselves from treating in a general theory of cosmos of any one of the transformistic doctrines in particular, but we will make a slight notice of them in order to present in a brief classification the principal points of difference among them. All are under the same principle, but contain two series of explanations, so that we can classify them into two groups according as they refer to inorganic evolution or to organic, and if we do not take into account the slight variations on particular subjects we may reduce to two hypotheses all those belonging to each group. Those referring to inorganic evolution are those of nebulus and meteoric aggregation, and those referring to organic evolution are the monotypic and the polytypic. Taken in all, radical transformism is a full application of the supposed idea of the old alchemists of the existence of the philosopher's stone with which they hoped to engender in the laboratory all the minerals, and even to transmute base into precious metals, with the difference that transformism goes even further, extending the power of its *basical stone* to that of engendering living bodies!

Organic like inorganic transformism is simply based on the process of formation of concepts from mental abstractions; but we reserve for Biology the special criticism on the origin of organic species in general and of mankind in particular, and for this reason in this question there only remains for us to fix the concept of the word species, on account of the different interpretations it has received and the importance of the word in cosmic evolution.

We have already grouped the species under two headings—living species and chemical species; the former are frequently called also organic, and the latter inorganic, but we must keep in mind that organic and living are not synonymous, because organic comprehends not only living but dead structures which still retain the morphologic characteristics which they presented when they were alive. Chemical species are perfectly defined in their quantitative relations, which are in definite proportions when they are combined, and they form a series in a harmonic scale when they are in a simple or elemental state; these elemental chemical species are primitive forms thus created; there is no species newly coined, if we may use the expression; the species of to-day exactly resemble those of the past. Living species, like the chemical elements, are also created forms, but they do not follow exactly their former types; they may change in the conditions of their ulterior development, thus originating the different varieties which in turn may be mixed by the act of fecundation, so giving rise to more extended varieties. Thus there is something immutable in the act of fecundation which is the only circumstance that permits us to characterize the different species, and, indeed, if we exclude the character of their origin, we cannot define the living species, because we do not know the characteristic of their quantitative relations as we do in the chemical species. We must admit, then, the existence of species in the two kinds of bodies in nature, that is, in non-convertible inorganic formations and in non-convertible organisms, with the only fference that as the former are simple and homoeneous in themselves they can be very well difrentiated numerically, while the living species are complex and heterogeneous in themselves that they annot by any means be numerically defined or etermined.

The natural species exist from the Creation, but an classifies them according to their manifested analogies, although the analogies among the different species are referred to conditions that are not inherent properties but mere abstractions of concepts which only express facts of quantitative relation without stating the cause. The "why?" is always the universal potence which is only one and perfect in goodness and beauty; the multiplicity of the effects depending on the mutual relations which are determined by the conflict of every part of the universe with its extreme conditions.

Some writers object to the admission of the specific power of the Engendering Cause because from the same parents different creatures can be born, even if they develop under the same external conditions; but the xamples they give are of course deceitful appearances, because it never happens in the world that in all the relations of two changes there are any two conditions identical; the Engendering Cause is the sole invariable condition, otherwise we would be obliged to affirm the contradiction that one thing could be one and many at the same time. They also say that inheritance of traits from distant ancestors may occur without any manifestation in their intermediaries, but such an observation is made even with the faulty intelligence of wrongly interpreting what the word "inheritance" means in the succession of organic individualities, and they exclude from the concourse the extrinsic influence of the medium. The act of reproduction is a continuation of the ancestor in connection with the Engendering Cause; there cannot be multiplication of beings without particles of organized bodies serving as germs, which, separating themselves and growing, form the new, individuals; consequently the constant and successive generation of living individuals is not a complete creation but a succession with multiplication of the effects arising from the organizing potence. For this reason the word "genesis" and its derivatives are employed in Physiology in a figurative sense and not exactly in their etymological meaning of "creation." To affirm the possibility of new creations would be the same as to defend spontaneity, and this is the error into which transformism has fallen.

With this we have said enough on this question, in which all explanations only serve to set back and complicate the mystery in order to put it at an immeasurable distance from our understanding, and when it is shrouded in such a heavy fog that no eye can distinguish anything, it is then that transformism tries to show the origin.

Accordingly, in our opinion, contrary to the reigning assumption of transformism, the evolution of the universe cannot be scientifically discovered either in its principle or in its end; but the proof of this proposition requires further argument, so that we will devote to it another separate article.

§ 61. THE DOCTRINE OF COSMOGONY IS NOT PHYSIOLOGIC.

The science of the formation of the universe, or Cosmogony, belongs not to the science of nature—Physiology, but to the science of the supernatural—Metaphysics. We are now to consider this proposition, or which it is necessary to review some data previously given.

We must all be convinced that the constituents of the universe form a true system, and that the position and action of the different parts of the world are under the conditionality of its relations with the whole, this being not a sum of independent elements, not a simple aggregate of things entirely isolated from one another, but a community in which all objects are in mutual dependence. There are no absolute individualities in physical cosmos like a true primordial cause, nevertheless all physicists are constantly falling into the fallacy f supplying matter with abstract or causing forces, hereby implying mutual independence among objective hings.

Vitality, phenomenally considered, also represents a ommunity whose functions consist in a partial synthesis f the general changes which are singly manifested in norganic bodies, although in these they are consecutive o the progagation of movement from organized bodies. Vitality in all living matter must have its functions and follow all the phases of its natural development n accordance with a plan, but although this plan is a unity there are variations in the consequences depending n the interaction of every living body with its cosmic medium.

In our physiological inquiries we have finally reached a point whose discussion, we repeat, belongs to metaphysical science: What is the cause of organic generation? But we have answered this question without prejudging anything of the nature of the Creator and his connection with the created; without transgressing the bounds of Physiology we have concluded that matter alone is not sufficient in the universe, and that its activity must be subordinate to an ultra-material, supernatural, or immaterial principle. We do not need to discuss whether the immediate cause of organic generation is a special vital agent, or whether it is the rational soul itself but with unconscious activity, or else whether the Creator is directly the great Architect or proximate agent of the generation of all living beings; what we do need to know is that an organized body cannot be engendered by the action of material elements alone, and that from the admission of the contrary the most mysterious conception of matter results when physicists try to explain its evolution. Nevertheless we have given our opinion on this point, because if the admission of intermediary principles like vital agents and unconscious activities of the soul only complicate and remove to a greater distance from our understanding, the explanation of the causal process, we set aside the existence of agents emanating from the Supreme in order to direct organic generation; it is clearer and more in accordance with our perception to admit the direct intervention of the Creator in such a process, as all that we can perceive is either subject (mind) or object (matter), and so we may imagine the abstraction of the generating cause as the supreme subject or supreme mind. Hence we admit that in the organisms matter is combined, forming highly complex structures in accordance with the direct realization of the divine aim, and for this purpose it must constantly dispose of the forces that such an end demands, but such protogenesic force, or, better to say, the origin of changes of movement, is not the effect of powers inherent in the elements of material nature; on the contrary, all inorganic activities are in their promotion the result of the functions of organism. Accordingly, the Primordial Cause is not only the creator of the physical elements but also the generator of the series of activities that are necessary for the development of the organic world, from which, we repeat, all the energies we recognize in inorganic matter are derived.

How, then, can we expect that a ray of scientific light could ever spring from the highest intellectual effort to illumine the eternal mystery of the Creation? It is impossible, and therefore Cosmogony must not be considered as a problem of physiological science; it is solely under the dominion of belief. Thus, when human intellect is ambitious to explain or comprehend scientifically the mysteries of creation and organic generation, it can do no less than wander away from the true path and lose itself either in grotesque hallucinations or in chaos, imagining a cosmos in incomprehensible disorder whose principle is eternal confusion, an image only compatible with the mental rachitis of blind incredulity. Experience, guided by rational reflection, as well as the self-consciousness of most minds, conduces to the belief in the existence of a primordial motor which is the Creator and Generator of the universe, in opposition to atheism, materialism, and modern transformism. These doctrines set out to explain the origin of the universe as an absolute whole deduced from the laws of dynamism, which is a complete absurdity, because there is no foundation for any hypothesis which supposes that we can understand what lies beyond the mutual dependence of object and mind. The only thing that our intelligence can comprehend is the knowledge of such a dependence which is reduced to quantitative relations, and therefore in such a mutual dependence among cosmic objects there is no antecedent which can be the primordial cause. Nevertheless, we have seen that these false doctrines uphold such inconceivable absurdities as the idea of the construction of all nature from pure ether, which as a material thing must completely lack attributes; and many even affirm that the physical world has sprung from the concept they presume to have of zero, which equals nothing; and still others derive it from the existence of an impersonal or non-subjective will. The fallacy of all these can be seen at a glance because they are even fallacies of language.

Besides this, a cursory observation shows us the impossibility of scientifically fixing epochs in the supposed evolution of cosmos because the time necessary for the production of a change varies in the widest degree with the conditions of activity. Thus, for instance, a change which at the temperature of zero needs some centuries to be effected will need at 100° only a few years, at 1000° only days, at a still higher temperature only hours, and higher still seconds. As a proof of this we may observe that in the operations in a chemical laboratory a transformation which at zero needs many years to be effected can be produced in a short time by having recourse to very high temperatures. In addition to this motive of error, that is, calculating the epochs of cosmic evolution, there is another cause of error which is not dependent on the conditions of our planet but on interplanetary connections, so that we call attention to the extraordinary terrestrial changes which can be effected by some variations in planetary interactions. Who, then, is capable of expounding the results and necessary time for one of those phases of engendering evolution? In our ulterior existence let us suppose, for instance, an increase of interstellar pressure, which pre-supposes as its direct cause an extraordinary propagation of living force from some of the planets for which a disorganization beyond that of ordinary conditions must take place, like a great fire destroying more organic material than can be at once restored, the result of such an increase of interplanetary pressure would be then an increase in the condensation of bodies producing a greater emission in their interstitial progene; this escape of progene would produce great molar movements like those of earthquakes and magnetism, great molecular or thermochemical changes also, and greater progenic impulses either confined (electricity) or diffused (photothermic radiation); and from this last the divergence of the orbital curve followed by the planets would increase. But if the planets become then more widely separated or deviate more from their great centre the increase of manifested activity now mentioned would very soon be followed by a compensating decrease of the energy of solar reflection, so re-establishing promptly the equilibrium of actual phenomena. By such an interplanetary change how many transformations could then be developed in a moment which under normal circumstances could not be produced in ages!

Furthermore, two very different things have been confounded by writers on Cosmogony, this is that the phases which they suppose a limited part of the universe have followed, have been referred by them to the universe in totality, committing in the generalization an error of principle. Thus then by every path we come to the conclusion that the problem of the primordial formation of objects in nature cannot be studied and resolved by physiological method; it is a metaphysical thesis. Every assertion made on physical grounds about material change or evolution must be partial and not total, that is to say, geological knowledge cannot in any manner explain the Creation but only the mere metamorphoses of things already constituted. Thus, Geology, with its ridiculous pretence of teaching the Creation by discovering the changes or differences existing in a limited part of the universe has, we repeat, for a principle and conclusion either chaos or fatalistic spontaneity. This is not only a conjectural idea but a false and vicious creation of language; it cannot be even a mental presentation, as it is inconceivable; all knowledge on generation in the physiological order is only apparent, because what rational experience really observes is that something never comes from nothing, that there is nothing spontaneous or newly created, and no existing thing is ever annihilated. The Book of Genesis, which treats of explaining the work of Creation, presupposes the belief of operations engendered by a primordial motor capable of executing its purpose in accordance with the formula $r > f$ (manifested resultant greater than living force employed). This is evidently of the metaphysical order, but in our desire to distinguish how physiological theory may come into accordance with Christian Cosmogony we can make a brief excursion into metaphysical ground with the principal aim of knowing more clearly the limits of physiological knowledge.

The affirmations of Cosmogony are inconceivable as a scientific theory; the creation of the world from nothing, and the transformation of the universe from an absolute uniform state to its present phenomenal condition or permanent variation are mysteries for our intelligence for ever physiologically irresoluble. We may enunciate these mysteries more clearly as different successive acts as follows:—

1. The primordial origin or creation of matter in a uniform and perfectly metafluid state, that is, as if all objects were reduced to the simplest or progene.

2. The condensation of progene into inorganic elements which are irreducible or non-convertible and which presuppose the formation of indivisible particles—atoms—of equal density but with geometrical differences of volume and figure.

3. The formation of living bodies and organic generation to produce growth and reproduction.

4. The generation of mental power and its successive operations constituting the capacities of the mind, which does not determine all the operations of its activity by dynamic changes, because in the mental process there is no definite space, and it is only revealed to us intrinsically, that is, by consciousness.

The first act of these four now enumerated represents our first mental abstraction of a "substance" without taking the other conceptual elements (activity, space, and time) into consideration; in the second we make the abstraction of material activity, but as existing in an absolutely uniform movement; in the third we take into account the abstract cause of manifested changes in the world—organic generation; and in the fourth we abstract the qualitative ideas as engendered by the exciting impressions from the object, which propagate nothing to the mind but progenic movement, which can differ only in quantitative relations.

The philosophical school called positivism has fallen into the other extreme opposite to evolutionism and admits only as true abstract knowledge that which is physiological, considering as negative all philosophical inquiries which go beyond the immediate relations of phenomena, and therefore it denies genesis; but positive knowledge so-called cannot satisfy the moral necessities of humanity nor the intellectual ambition of those who feel themselves impelled to investigations regarding the cause of the phenomenal world, and we must here remark that perhaps all who call themselves positivists do not content themselves within the intellectual bounds marked by their school; they are positivists in name but not in fact.

From all this it results that physiological sciences have no experimental data referring to the acts of creation and organic generation, and consequently they must be limited to the study of the history of cosmos in its present involution, considering only the changes of actuality and material potentiality. The physiologist cannot comprehend even the "Why?" of the fundamental principle—conservation of energy, and this would be sufficient reason to deny his authority in a criticism of the genesis; he has no data to explain any of the transformations in which the resultant living force is greater than energy expended; neither can he fix epochs, short or long, to the ages in which he presumes from his geological studies that the transformations of the universe have occupied. Therefore, it is but a useless waste of time to seek a physiological solution of the questions of genesis, and explanations for the agreement or disagreement between the false conclusions of most contemporaneous scientists on the cosmogonic problem and religious traditions. Physiology must be positive in a relative sense, and must prosecute investigations only of what can be demonstrated by facts of observation; only these and their relations compose the knowledge of the object; it must not follow the investigation of the first cause nor of the end of the changes, as such problems cannot be resolved by experience but by pure reason, because they transcend physical grounds and must be treated in metaphysical sciences, which try to remove the veil that conceals the connection between the finite and the infinite.

§ 62. CAUSAL DETERMINATION OF THE UNIVERSE.

The object of this article is to inculcate in the mind of the physiologist the notion of the cause of the system, in order to correct the common tendency which those have who do not possess fundamental speculations, either to fall into mechanical positivism or into sensational doctrines. These refuse to acknowledge the investigations of the causes, and do not admit anything else within the possibility of the understanding than the study of phenomena; they pretend that sensation is the sole source of knowledge, and because the senses cannot discover the true cause they deny its existence. In trying to avoid this fallacy we must not go to the other extreme, that of supposing that the acknowledgment of the assistance of a cause denotes its essence or qualitative nature; let us see, then, what is the just concept of the causal determination of the universe.

We have already demonstrated the absurdity of those vain attempts to construct the system with atoms alone, in imitation of the Greek atomists, and also of the most unreasonable idea of admitting the substantial reality of space. Such absurdities in the concept of the universe must give place to the admission of a generator of its activities as the sole causal determination, instead of that multitude of nominal agents like the so-called molecular forces attributed to matter, and which cannot be agents at all, being only the measure of some effected movement. It is certain that all activities are determined in their nature and mutual relations by the plan and nature of the whole system; but we must not confound the forms of activity which produce natural manifestations or phenomena with their primordial cause, and in the successive order of the relations between cause and effect we must distinguish that which is immediate or direct from that which is mediate or indirect. Thus the definite acts or phenomena like those manifested in inorganic bodies must not be considered as directly or immediately proceeding from the Supreme Being, but as secondarily derived from vitality, which represents the synthesis of all the changes produced in organism, and whose manifested functions are like any other phenomena derived from organic generation. Hence, the proximate cause of the relative unity of cosmic mechanism is not the atom, but the primordial potence of living activity—organic generation—which at present is the sole, immediate or direct effect of the infinite on material ground; such a primary effect is the only change which has directly received its conditions of nature and mutual relations from the nature and plan of the whole, and such relations will be constant if the plan of the cause requires constancy, and if the plan demands progress the organizing activity of living matter can pass from low to higher forms.

Objects having a fortuitous existence under the plan of the world, it must be possible to change their characters according as that plan is developed ; in what, then, consists the dependence of objects among themselves in accordance with their necessary interaction in the system ? We must always distinguish, we repeat, that which is effected from that which causes the effect. We have seen that living germs and the anatomical elements which they develop, when chemically analyzed, are constituted of a few inorganic elements equal in all beings, though the proportions in which these are combined and the relative aggregations of the compound so formed are different for every living species. But such a collocation of particles then for the construction of organisms must be governed by rational laws, which are necessarily dictated by an intelligent principle ; this employs in matter only its quantitative reason, reserving the qualitative for the procreations conscious in themselves, that is, the mind. By this inquiry into the first effect we arrive at the fundamental distinction or division of bodies into inorganic and living, which division has no other essential difference than that of the origin of these bodies. We have already seen that writers on natural history usually try to explain the difference between living and non-living matter by simple material analysis, a vain task, because the mental impossibility of qualitative distinctions among objects is demonstrated, and the analogy of the material which composes all the natural kingdoms is therefore widely recognized. Convinced of the truth of this conclusion, some authors have contented themselves by saying that the sole differential or essential characteristic of inorganic bodies is that they have no life; but that does not convey any scientific knowledge; it is a phrase that involves a mere play of words, in which the definition is already connoted in the same term which it is attempted to define. Some other naturalists correctly deny all differences among existing things, but then they erroneously affirm that everything in the universe is the same thing, and that there is nothing supernatural.

Organic generation is an eternal secret; it is a mystery that will never be penetrated by human intelligence, and the cause of such a change is a supernatural power which, although unknowable in its nature, we are compelled to acknowledge in accordance with the following argument. No one doubts that man is the supreme being among those which have material existence; now where is the man who has the power to execute a work according to the formula of cosmos $r = f$; or, in other words, can man practically resolve as cosmos resolves the problem of continuous movement? What being in nature, then, can elaborate anything according to the formula $r > f$, as is the work of organic generation? Hence, it is most irrational to suppose that carbon, oxygen, hydrogen, and nitrogen, associating among themselves, could be the authors of the uprearing of a structure, whose conditions and work are far beyond what even the best mechanician would dare attempt to produce. If the pretension of resolving the problem of perpetual movement ($r = f$) has been opportunely qualified as an insane idea, how must we qualify the pretence of resolving mechanically the problem of the cause of vital movement, which produces (according to the formula $r > f$) organic generation in its two forms—growth and reproduction?

Causation implies determination, but not all determinations are causal, material determinations being, on the contrary, effects or derivations which can be brought within the logical domain of reason, as in them we can know the consequents if the antecedents are given. Our mission in Physiology does not extend to causal determination, but only to those which are mechanically derived, and the conditions of these never depend on one thing alone, but in the mutual intermotion of many things; because if only one thing were sufficient to determine an effect in the world, the cause and the effect would be co-existing, and then all effects would take place simultaneously. The contrary of this is the case with the changes effected by the system; they successively result from the mutual action of parts, that is, from interaction. Then all the conditions of the parts are equally co-operating causes of the effected determination, and, therefore, objective things must be such that when the causes are determined the effect must necessarily be produced in accordance with the guarantee which the universal postulate—uniformity of nature—offers. This conclusion is altogether different from that which supposes that one objective thing alone can be a sufficient cause without taking into account its relations with or dependence on the others; for, we repeat, in order to obtain any effect in nature, co-operation is always necessary. Therefore, the word "cause" in Physiology has only a relative signification, it represents a nominal abstraction of all conditions necessary to effect a physiological change, which is never a creation but only a variation in the form of propagated movement. Thus objective things are not created nor destroyed in their mutual actions, they only pass into other conditions. The effect of such a change may be phenomenal (manifested), or only potential (not manifested to the senses and known only by mental reflection); but in neither case do we know the actions in themselves, but only the relative consequences of the interactions.

We have no real experience of interaction; it is only a mental affirmation inferred from the antecedents and consequents of a change; so to know how material or physiological actions are produced is a problem of the intellect, and not any fact of irreflexive experience. Nevertheless, action is commonly conceived by physicists in a figurative or imaginary representation as something transferred from one object to another, but if the states, conditions, or attributes of objects are nothing that can be separated from them they cannot be transferred; the idea of transference results only from the mental tendency to substantiate abstractions. The cases which have principally given rise to the erroneous conception of substantial transference are those observed in the propagation of molar movement and heat. When a body in movement communicates movement to another body and stops moving itself, we see, that is, if we do not employ reflection in the data of experience, that the movement has been apparently transferred to that other body. The same apparently occurs in the propagation of heat; the body which is hottest loses temperature in proportion to the rise of temperature in proximate colder bodies. But these are facts to which we must apply rational interpretation in order not to be deceived by sensual or irreflexive appearances; and these facts are called transferences in a figurative sense, expressing then a description of the facts but without interpretation or explanation of them. Besides, in such a descriptive denomination we do not employ the appropriate terms, because a state or condition without an object is as inconceivable for the mind as it is impossible for matter. In all interaction then there is no transference; there is only propagation. Nevertheless we employ the word transference for the cases in which propagation is produced with change into a different kind of movement, as heat into molar movement, etc.

Interaction is impossible if we consider things as independent, because what is a reality absolutely independent must contain the cause of its determinations in itself, but what is under the necessity of interaction must have the conditions for its determinations in other things as well as in itself. Any attempt to harmonize independent things in a universe by means of forces or physiological influences results only in a play of words impossible to understand. Such expressions as "universe" and "abstract forces" represent concepts which cannot be combined in any manner among themselves because they are contradictory to one another. The abstract forces considered by all scientists as causal or primordial determinations must be altogether eliminated from scientific terminology, as in such a signification they are only expressions of ignorance in the succession of effects. In addition to this, interaction and independence are also contradictory, and as we are obliged to admit interaction among objects we must deny independence. Therefore, we affirm that the plurality of things is reduced to dependence under a comprehensive being which can be the unity and co-ordinator of the parts and of the whole. When a series of things varies with order it is impossible that all can be absolute unities; there must exist one which directs the community, and the whole, being a system, can never be comprehended as the sum of the parts, but the parts must be considered as phases of the whole subordinate to an absolute and truly independent unity, to an omnipotent being to which everything is omnipresent. Thus, then, interaction in nature is not a property of matter itself; it is an effect, and therefore the generation of mutual actions depends on the Creator.

It is not our purpose to investigate how this cause determines interaction; the physiologist must study only the derived effects, that is to say, the extrinsic or objective action of matter, which consists in a mutual collision either of the material elements or of bodies, a mechanical change or variation of movement being produced as the effect of such collision or contact. It is impossible to determine any physiological change without contact between that which is the relative cause and that which is effected, the action which appears to be produced at a distance always presupposes propagation by means of interactions in which the play of some intermediary propagator is unknown; there are no physiological actions at a distance such as are implied in the enigmatic forces, attraction and repulsion. The proper meaning of force then is reduced to represent the measure of the resultant from interactions in nature, and the notion of conservation of force in the mutual action among the things of the physical world is an imperative necessity in the universal system, while it follows the uniform evolution which we observe in the present and the past of nature.

The cause of interaction is a metaphysical principle as we have already said; everything in the universe results from a primordial action whose agent is unknown to the light of our intelligence, which can only acknowledge it by the results of such action. The universe being in such marvellous harmony gives us faith in optimism, that is to say, in the doctrine which teaches that the primordial agent, operating as a determining cause in the generation of organisms, orders all things for the best; so that the fatal cases in the mechanism of the world are derived or secondary, that is, subordinate to the interaction of living and non-living bodies, and are therefore only accidental results. Although it is impossible to draw any exact parallel between the supernatural subject and the object, our imagination can draw an artistic representation of this case comparing the Great Organizer to an engineer who directs all the operations of an engine for which his arm is the moving power. If, then, application of the machine is made to some work, and if in its interaction with the cosmic medium which is around or on which it operates a break occurs in it, that is an accidental effect in relation with the motor or moving power. Now in a manner similar to that in which all the changes of a machine are connected with one another, however different they may be, the changes of the universe are also connected, resulting from the same motor, which acts with a constant law in the mutability of objects, directing and preserving the world with uniformity, so that we observe His law is inviolable and eternal.

Accordingly in all and everything the light of reason illuminates the idea of the necessity of a Supreme Cause which reconciles in His infinite unity the individuality and community of the universe, considering all natural things as partial elements of a system which has its transcendental action only by the influence of a fundamental, infinite, absolute, and independent Being in which everything else finds the cause and reason of being as it is.

§ 63. RECAPITULATION OF THE CONCEPT OF THE UNIVERSE.

Physiology presupposes attributive identity (only one substance in activity or movement), the differences being due only to relative changes of space, or of time, or of both. The only possible knowledge of nature depends on the condition that all change is a transformation. Matter changes by the union or separation of parts, but through all these transformations we must suppose that material substance is always identical; and we may say the same in regard to movement, which may be distributed into greater or smaller masses in a form either manifested or latent, but material activity is always movement. Thus the Great Architect with His true purposes of goodness, beauty, and harmony, directs organic constructions, engenders in them disposable energy and phenomenal movements, governs the course of cosmic material, but without changing the total quantity of matter in movement, that is, without ever newly creating or annihilating. He only engenders relative metamorphoses in the redistribution of the same quantity of matter in movement. The concept of conservation of movement is altogether different from the continuation of the actual energy of objective things in the universe ; the former expresses a fact derived from the true creation, while phenomenal activity is constantly engendered by the transformation of potential energy in organisms under the direction of the Primordial Motor. The work directed by the Creator not only preserves the quantity of matter in movement in its mechanical relations, but the persistence of the Supreme purpose in the good and beauty of its execution is denoted by the *uniformity of nature.* This ultimate postulate is presupposed before any calculation or determination of the quantitative relations are made ; it is directly induced from the qualities or subjective differences, and for this reason we may say that the postulate *uniformity of nature* is the fundamental principle of attributive abstractions formed from objective analogies, while the principle of conservation of energy is the fundamental law for the relations from objective differences. Accordingly, the true idea of conservation or persistency in universal mechanism presupposes that the partial forms of the enunciation of that principle are erroneous, so that we must not say there is conservation or indestructibility of mass in the world, because the quantity of mass is variable ; neither can we affirm the conservation or indestructibility of abstract movement, because the quantity of existing force, considering this separately from mass, is not always the same, but varies like any partial relation.

Without the evidence of the principle of successive continuity and uniformity in nature between antecedents and consequents, science could not infer its great prognostications; it could not determine by the present state of things, either the past or the future, as there is no doubt that our scientific calculations would fail if there could actually be new creation or annihilation in the factors of mechanism. But it is impossible that the regularity of the established and necessary order in cosmos should fail, because the work of the Almighty being true, good, and beautiful in absolute, it could not be otherwise than as it is.

In the comprehensive theory of cosmos we omit the intervention of any agent acting as causing force, as we have done in the theory of Analytical Physiology, and in Biology also we deny the intervention of any special force in life. In this manner we dethrone the gods of the scientific Olympus, and admit only the one of most elevated rank—the Directing Power of Vitality which cannot be other than the Creator. Force must never be considered as having an existence separate from objects; mechanical force is not an absolute and primordial cause of nature, but simply a measure, and therefore it is a relative determination of quantity, an effect which becomes at the same time the proximate cause of manifested actions, so that it is a secondary cause in the successive changes of nature. Force expresses the determination of the quantity of movement propagated in a physiological change, or in the changes of a partial system, as occurs in the synthesis of life. If we conceived force in a metaphysical as well as in a mechanical sense, it would become an equivocal term, representing then in the metaphysical signification the True Cause, the Primordial or Engendering Potence of Vitality, because if we prefix to the word "force" the adjective primordial we indicate what the Divinity does in cosmos, instead of the effected potence and phenomena.

All phenomena are mechanical in the true sense of this word, as they are always the effect of some change of matter in movement; therefore, it is erroneous to admit the abstract conception of mechanism as an independent reality; all phenomena take place within the universal organism in which any mechanical notion or effect of movement cannot be separately conceived; it can be conceived only as a mental or verbal abstraction without an existence independent of the bodies, like colour or any other so-called property.

All phenomena compared according to the standard of discrete quantity are quantivalent in their mutations, so that all natural changes (molar and physico-chemical) are subordinate to the rational principles of quantity, as the so-called laws of mechanism are nothing more than corollaries derived from the universal principle of conservation. In any functional transference or propagation of vitality, as in any other physiological change, we must admit the principle of mechanical quantivalence, that is, a proportional interchange in the energy of antecedents and consequents. Therefore, in organism as well as in inorganic machines, there is always a direct relation between the molar work produced and the heat expended; this in turn must be in direct relation with the chemical movements which produce it, and these reactions must be proportional to the progenic currents which change the position of the molecules.

If Mechanics were well known in its most comprehensive or etymological signification, it would be considered the science which would interpret the genesis of natural phenomena, and would embrace the study and explanation of all material mutations in cosmos, determining the force of every change, which, in corpuscular matter, is equal to the product of the mass, and half the square of the velocity. The physical, chemical, and biological theories, now widely disseminated under contradictory principles must be thus unified.

All material changes, whether manifested or not, though multiple in the sensual appearance, always arise from matter in movement. Hence we repeat that all mechanical force must always be supposed as a concrete measure comprehending the two factors of all movement—mass and velocity; we must never suppose the ideal existence of abstract forces without dimensions moving across empty space, neither must we admit them to explain the functions of organism.

Cosmic and biological syntheses, inasfar as we can know them, are under the control of Mathematics. A true inquiry into nature and the proof of physiological truths has for a base the facts of extrinsic experience from which our reason calculates the relations which must serve us to develop the Physiological Theory. Mechanical theorems are the real guide of physiological science; the principle of conservation is common to physical and chemical changes, to acts of vitality, and to astronomic movements; the calculation of the movements of visible bodies (Molar Mechanics) must be applied to the invisible particles called molecules (Molecular Mechanics), and to progenic (Progenic Mechanics). When we question the material world, whatever its state may be, the determination of quantity by calculation (*i.e.* by the infallible law of number) is a help of undoubted exactitude. But, unfortunately, we cannot numerically determine phenomena in all cases; science has scarcely passed from the analytic acquisitions of irreflexive experience, qualities for this reason being yet erroneously considered as objective properties. In actuality much imperfection of true scientific knowledge yet prevails; nevertheless, it does not weaken the base on which the principle of conservation rests, because our intelligence, penetrating more deeply than our senses, foresees the true analogy where sensations show us what falsely appear to be essential differences. Although up to the present time science has not been able to prove numerically all physiological facts, we have arrived at an ultimate principle which comprehends them all, both known and unknown—that is, though much remains to be discovered, we have sufficient knowledge to declare that all the laws of the science of nature are comprehended in the principle of proportional interchange (quantivalence), which is synonymous with the principle of persistency or conservation. For this reason, after numerous observations, we have convinced ourselves that all future discoveries will be subordinate to the universal principle of conservation, and in accordance with the ultimate postulate of uniformity; hence the true progress of the Physiological Theory consists in explaining the derivation of all empirical laws actually proclaimed in Physics, Chemistry, Cosmology, and Biology, by the conservation of energy in Cosmic Mechanism.

In the Physiological Theory we must not confound the evident principle of *conservation* of energy with the erroneous supposition of "continuity" in transformism; this doctrine employs the word "conservation" in such an ample sense that it completely lacks a fixed signification. Furthermore, transformists include in "continuity" the reason of its antithesis, "variation," although they pretend to disguise the opposition of contradiction of terms with the adjective "infinitesimal," and then qualify as continuous the variations they call infinitesimal. The Physiological Theory resolves this problem without the intervention of moving forces in nature, and without appealing to such a fallacy as that of transformism; in fine, it determines that cosmos does not follow the phases of transformistic evolution, but is in a true involution.

We admit only one substance and one form of activity in matter, but not atomic unity. To prove the identity of matter or substantial equality of all the objects of nature it is sufficient to know that we cannot perceive in them more than differences in the relations of space and time, as all sensations result from propagation of movement which can be but of one quality. Qualitative differences are formed in the mind from such quantitative changes; they are not really objective, but subjective, therefore progene (the ether of the physicists) must be considered in its natural quality or essence as a substance identical with ponderable matter, and all bodies, even those considered elemental in Chemistry, must also be considered identical in their essential quality.

We must not confound this idea of material unity with that asserted by atomists. We cannot admit atomic unity, because among other reasons the principles of thermodynamics are sufficient proofs to convince us of the error of the atomic hypothesis of progene, which must necessarily be distributed into variable parcels.

The atomic hypothesis assimilates progene to the gaseous state, but this is completely contradictory to facts, and insufficient to explain imponderable changes. The difference between progene and atoms lies only in a relation of condensation, the atom being an invariable corpuscle of almost twice the condensation of progene, as the calculations of propagated energy lead us to infer by showing us a dissipation of 46 per cent. of manifested or living energy which, as we have seen, is a loss resulting from gravitation, an effect of the action of progene on atoms. The condensation of matter in atoms must be equal in all bodies, as such a ratio is invariable, the differences between atoms thus being in volume and perhaps in shape. Such an idea of substantial equality, though undoubtedly a true one according to mental analysis, has not a practical confirmation, for in the laboratory all bodies cannot be reduced to one alone.

The realistic idea of chemical transformism pretends to be based on the unity of matter, but such a hypothesis, like all those which try to explain the evolution of cosmos, surpasses the limits of positive knowledge. We must restrict ourselves to the possibility of physiological succession discovering always and everywhere in nature effects alone; we can never explain the true cause, nor investigate the primordial genesis of cosmos. Such inquiries belong to Metaphysics. With this restriction of Physiology to calculate effects alone, *i.e.* to establish the relative laws among the objects of nature, we will consider progene as the first material element of evolution in cosmic mechanism. The different forms of matter in the constitution of cosmos may be shown in a progressive table as follows:—

Simple bodies practically irreducible.	1. Progene = imponderable matter (ether of the physicists).
	2. Protile (helium ?) = primary condensation (perfect gas?).
	3. Most permanent gases = secondary condensation.
	4. Simple bodies that can take a liquid form (many elements).
	5. Simple permanent solids = carbon.
Compound bodies reducible to simple bodies.	6. Compounds without carbon.
	7. Ternary compounds of carbon = hydrocarbonates.
	8. Quaternary compounds of carbon = albuminoids.
	9. Protoplasm = organic granular matter.
	10. Ovules = unicellular organisms and germs of all living bodies.

It has been proved that we cannot interpret this scale by the doctrine of infinitesimal continuity—the fundamental principle of transformism ; and that we must not suppose because matter leaps infinitesimally, or changes gradually from one form to another, that such a change can be made by matter alone without the intervention of the Motor.

PRINCIPAL CONCLUSIONS OF THIS PHYSIOLOGICAL THEORY OF COSMOS.

SUMMARY.

1. *Physiological theory is still very defective*, especially in the quantitative or correlative determination of those changes in which propagated movement is invisible in inorganic bodies as well as in the functions of vitality.

2. *The principle of conservation of energy* enunciates a quantitative correlation among the antecedents and consequents of all physiological or mechanical changes; it is only an inference drawn from the facts of *inertia of matter*, and it has as a future guarantee *uniformity of nature;* hence it is not a causal determination.

3. *Mechanism—object of Physiology*—is nothing really independent; it is only the concept of a mental abstraction in which we make the ellipses of the Primordial Cause and of the mental subject; hence it comprehends the effects of material motion alone.

4. *Matter*, in order to be an object, can only be conceived as a substance in activity, occupying some space and existing in relations of time. Hence the division of object into matter and force, mass and movement, protoplasm and irritability is purely ideal or conceptual.

5. *Physiological change* always results from propagation of movement without any new creation or annihilation. Hence the differences among material changes are only quantitative—relations of space and time; the qualitative nature—substance and activity—being always the same throughout all nature.

6. *Monotheism is the true doctrine* of all causal determination, admitting only one cause of unity in the universal system, and hence rejecting abstract or causing forces, and also atomic unity throughout nature.

First Conclusion.

§ 64. PHYSIOLOGICAL THEORY IS STILL VERY DEFECTIVE.

The method of proceeding with physiological studies is: first, *to analyze material things* or objective events as far as their ultimate factors; second, *to investigate the laws* which govern their combination or succession; and third, by the union of such factors in accordance with their laws *to construct mentally the complete object* in all the forms of its sole activity—*mechanism.* When this last deduction is impossible we cannot arrive at a complete or mechanical explanation, and in fact there are many cases in nature which are not yet susceptible of a rational explanation; this occurs with most of the changes in which movement is invisible, and with the functions of vitality. We do not take into account the primordial effect which is produced in organized beings, and which may be known only as a fact referred to the Prime Cause, but never as constructed by manifested antecedents, and therefore it is not within the reach of physiological acquisitions properly so-called. Our study, then, is limited to material concepts, not including either the knowledge about the origin and end of things or mental activity. The doctrine of primordial genesis—Cosmogony—is not physiological; it is metaphysical, because the facts of creation and organic generation, in which we comprehend not only the acts of reproductive inheritance, but also of nutritive development, cannot and never will be rationally connected with mechanical antecedents; in creation and in vital generation there is a general order or uniformity which reveals the succession of the changes of nature in accordance with an intelligent, supreme law, and this idea is contradictory to chaos or fatal mechanism. Physiology must treat only of knowledge acquired by sensual data; it must not comprehend the totality of the universal system, but only the mechanical world, whose actual synthesis is the proximate effect of the activity of living bodies.

Physiological explanation of change must never pass beyond the numerical equivalent or correlation between antecedents and consequents, but this is not to assert that we find tenable the idea of scepticism, which affirms that a mental satisfaction of causality can be found merely by numerically determining the relations of material effects. This assertion is erroneous, yet it is still a truth that physiological synthesis cannot have a perfectly developed theory so long as it cannot mathematically explain the changes which are combined in *vitality* and in cosmos. If we maintain a physiological theory under the preceding limits or restrictions we fulfil a just demand of science; our intelligence asks for continuity and law in the system, since to imagine a system without order in its process would be as absurd as to imagine a present state with only temporal relations with the past.

All physiological laws and propositions must be in accordance with a fundamental relation of all mechanical changes; such is the fundamental principle of conservation. But many inexactitudes in the enunciation of secondary laws, and in the explanation of material events, are noticed in all writers, for they frequently contradict the said fundamental principle; and in addition to this there are still many great difficulties in explaining some observed laws and facts. Again, some difficulties make reference to very palpable events, as those of molar mechanics, and yet an error has been committed in their concept, originating in a fallacy of language, taking what are simply mental abstractions as if they were concrete realities.

Accordingly, we have mentioned three different defects of Physiological Theory; one is a *defect of origin of change*, which is insurmountable and in reality beyond the limits of Physiology, and therefore we will not further concern ourselves here with this point; the second arises from *fallacies of scientific language*, either in contradiction to the fundamental principle of mechanism or in the realization of abstractions; and the third is a *defect of rational experience.*

The defects of contradictory or realistic fallacies must be corrected at once, as such a correction is purely a work of reasoning upon experimental facts; and so now we are to give the rule to clear the way on this point, but here in this conclusion we do not concern ourselves with the inexactitudes of the mechanical concepts er authors, as the conclusions on this criticism will tinued in the followed sections.

is certain that some laws of Physics are very clear eir consequences, such as the law of gravity in re or molar mechanics; for, assuming the truth law, it is easy to deduce the results as rational ities, the mind then feeling completely satisfied. theless, serious misinterpretations arise from the sion between theory and practice in molar nics, because the former is based in a series of abstractions which are very far removed from mas- alities. It is clear that this is in obedience to the sity of passing in the explanation from the simple e complex, because without beginning with the est case the complex constructions could have no ation. Without such a method, speculative theory be impossible, and for this reason Mechanics ses first points and lines, formed by continuous , then single forces acting on points, afterwards absolutely rigid, cords perfectly flexible, rotatory s or pulleys and other implements without friction, that the mechanician in the practical application theories needs to take into account the difference en such data and objective reality in order to ate resistance. But if the mechanician represents ality in mind by means of such abstractions, also lering matter as always homogeneous and abso- passive to which movements and forces are d, he must never confound such suppositions with xistences, and must constantly bear in mind that forces are not causes; that they represent the of the production of movement in the changes of ; and that the movements and forces manifested by the mutual action of objects express only the measure of a limited portion of the material changes of the system.

In regard to the defect of the present lack of rational experience, we may say that the idea of the physiologist, as of the mechanician, is to deduce every phenomenal consequent taking place in the world from its antecedent; but this cannot be done, as yet at least, with phenomena whose antecedents are invisible movements. Nevertheless, there is sufficient reason to affirm that if we could see interstitial changes more clearly we would also be capable of connecting their antecedents and consequents with the same mechanical necessity as we can now proceed with massive propagations of movement.

Many physiological problems are yet unresolved, such as the exact calculation of all the transferences of heat, chemical metamorphoses, sound, light, and electricity, and yet we may infer on principle that such processes are at bottom necessarily identical with the simplest ordinary mechanics, because they are all either potential or manifested changes of the redistribution of matter in movement; and consequently in whatever form movement may be produced, it must always be of the same qualitative nature, the difference being only in the quantitative factors—relations of space and time. Thus, then, no one who comprehends the idea of mechanism and movement, not only visible but invisible, can doubt for a moment that the changes produced in chemical metamorphoses, for instance, must be subordinate to mechanical laws as well as are planetary movements, nor can he have any doubt that the properties of complex molecules depend on those of the elemental components according as they exist in the compound, and therefore there is no reason for considering, as most chemists do, that chemical reactions are not so mechanical as the actions of molar gravitation.

Furthermore, in the same manner we must interpret all nature under the mechanical concept, confining our intelligence within the limits of reflecting only on the results of effects without inquiring into the Primordial Cause. Although up to the present time the result of investigations upon the changes of vitality has been altogether unsuccessful, the connection between antecedents and consequents being still unknown, such a connection is a fact of rational experience, but we cannot yet mathematically determine the results in an organic machine, and therefore we cannot numerically mark the propagations of movement in vitality, not even to the simple extent that we can in the inorganic world. Synthetic Physiology, then, especially Biology, must spring from the irreflexive state of actuality, surpassing its descriptive limits to investigate rationally in their quantitative correlation the effects derived from the genesic Potence of organism. When it makes this progress vitality, except in its protomotion or protogenition, will have the same mechanical explanation of its effected changes as the simple phenomena combined in it; but we must never confound such explanations with the things themselves, as the result of the process of reasoning is not the same as the genesic order of things; it is precisely inverse to that; the first effects we discover are those proximate to our senses, and consequently farthest removed from the Primordial Cause. This inversion between the logical order of thought and the genesic order of cosmic activity in the changes of movement must always be kept in mind in order to avoid a lapse into the monistic error of transformism.

Second Conclusion.

§ 65. CONSERVATION OF ENERGY IS THE FUNDAMENTAL PRINCIPLE OF MECHANISM.

The principle of conservation of energy signifies that among the antecedents and consequents of physiological change there is always quantitative correlation. The sole guarantee for applying this affirmation to future events is the universal postulate *uniformity of nature* which is inferred from our strong belief that the facts of inertia of matter will hold true at all times and in all material cases. Hence the principle of conservation simply marks a relation among objects and is not the causal determination of mechanism.

Material nature is inert in living as well as in non-living bodies; but we must not confound the term inertia, as is frequently done, with that of absolute passivity or absolute repose. Technically considered, inertia signifies indifference to movement, or, what is the same, that there is nothing in nature capable of engendering or annihilating the existing activity of matter, this only changing from latent to manifested states and the reverse. Thus we admit the phrase "force of inertia," which means the resistance of bodies to effect a movement, or to change either their direction or velocity.

The enunciation of the principle of conservation and that of the law of inertia are at bottom synonymous, and that contradiction which apparently exists between such terms arises from the vulgar idea of inertia, which is acquired by the sensation of the effort necessary to move ponderable matter, as this always has some energy of position which is the effect of the pressure of progene gravitating towards the centre of the earth. The rational signification of the word inertia and its true concept in science is, we repeat, that all which is comprehended in the material world is indifferent to any form of movement, and consequently that all objective change is produced by something apart from matter, as this has no power by itself to increase, diminish, or change the form of its activity; so that great contradiction results from the language of physicists when they affirm that the sole real things are mass and energy, and that matter is completely passive.

If inertia of matter implies that all manifested activity is determined by supermaterial or immaterial generation, and hence primordially originated by some agent apart from matter itself, the principle of conservation of energy must not be confounded with the *cause* which determines the persistency of objects in their actual manner of being. The principle of conservation sums up all the energy of matter, potential as well as manifested, but the actual state of cosmos supposes a persistent reparation of the manifested energy which is constantly lost in the mechanical changes of the world; such a reparation or protomotion is a change which must be engendered, and therefore it can take place only in organism. Mechanism by itself alone, *i.e.* without the activity which causes living generation, would soon be completely reduced to absolute uniformity of movement, and therefore would be without any manifestation or phenomenal change. But to suppose such perfect equilibrium and such uniform movement among all the parts of cosmos, if this could exist without living bodies, is exactly the same as the imaginary representation of a world existing constantly in invariable oscillation, and therefore without phenomena. Nevertheless, beyond this state still, the doctrinaires of transformistic evolution have reached to imagine a primordial existence of the world, in which all and everything was equal with absolute uniformity. Cosmos, then, would be a perfectly continuous thing, and therefore in absolute repose; but as it is impossible to conceive any kind of evolution arising from absolute repose, transformists endow the prime material—progene—with an inherent movement, which, according to them, was at first persistent and immutable. How, then, could progene, being matter, and therefore inert, be the source of all which is actually manifested, if, in such a uniform movement, and consequently without change, no phenomena can be produced? Inertia of matter is at present, has been in the past, and will be in the future the true condition of cosmic mechanism. Matter continually undergoes changes or mutations, but is never newly created nor annihilated, and consequently material changes can only be conceived as propagations of movement whose energy is preserved, and those changes which are manifested to the senses constituting phenomenal activity simply result from propagation of movement governed by the principle of conservation, as is inferred from the undoubted facts of inertia of matter. Accordingly, in the mechanism of the world the same energy is always preserved—conservation of matter in movement—and from this principle all natural laws are derived, and therefore the problems which come within the sphere of

Physiology are exclusively mechanical or material. But if the activity of cosmos presupposes nothing but propagation of movement in accordance with the principle of conservation, this is not the cause of mechanism but only the law according to which nature is governed, not by itself but by what is capable of being causal determination. This solution given to the highest physiological problem is justified in this book and in the special study of every material change in "Theory of Physics."

Third Conclusion.

§ 66. THE OBJECT OF PHYSIOLOGY IS MECHANISM.

Mechanism only comprehends the effects we can discover in the material world; it is, then, the concept of a mental abstraction in which nothing is really independent, its changes resulting from intermotion which is subordinate to the Primordial Cause. Thus, making the ellipses of the generating cause and of the mental subject, the physiologist completely separates the object of Physiology from Metaphysics, and for this reason we must not admit any other cause, not even in vitality, than the determining cause of organic generation. This becomes manifested in two functional ways: as molecular generation—nutrition, and as cellular generation—reproduction.

There is no doubt that we may say that the object of Physiology is purely mechanic, but this must not induce us to fall into radical positivism, which admits only the existence of what is physiologic; on the contrary, apart from mechanism, we must not deny a true cause, though this cause must be treated, not physically, but metaphysically. Experience is the only source of all the data (sensations) by which reason infers the laws of nature, these laws being relatively fixed or constant; but reason also discovers that neither the existence nor the conditions of cosmic mechanism are ontological necessities or independent things, and that the extension, duration, and character of cosmos are as the plan of the Creator designed them. A physiological explanation of cosmos only conduces to the knowledge of what manner within the system of nature one objective state results from another, and in what manner some factors are combined to produce a determined result; physiological theory, then, must not inquire into the True Cause, though it is obliged on principle to affirm its existence, but circumscribe itself to consider the world in its actual state and from this to infer the history of the order and the laws presiding over material changes, which are primarily determined by the cause implicit in the system, although it only manifests its actuality directly upon organic generation.

Under this criterion physiological theory simply comprehends, first, the analysis of the factors of nature —Analysis of Cosmos; and second, the construction of the resultant by the union of such factors in accordance with natural laws—Synthesis of Cosmos; in this manner the explanation of a physiological change consists in connecting it with its antecedents in accordance with the laws of material or objective succession; and the explanation of a compound change consists in referring it to its components. For this reason a correct analysis of living functions leads us to the knowledge that though they are highly complex changes they have no special quality; that physiological synthesis consists in a natural concurrence of the simplest material changes whose union forms a partial synthesis in inorganic, organic, and planetary bodies and that these together form only physical cosmos—not the whole universal system. Hence, physiological theory in its synthesis tries to compass the combined study of the same changes of nature which are separately studied in Special Analytical Physiology (see "Theory of Physics"). In fact, in Synthesis of Cosmos, we do not study anything new, as the living functions are but combined changes like those that take place in the inorganic world, but because of this we must not arrive at the erroneous conclusion of materialism which affirms that vitality results from material activity, when in the true order of succession the changes of the inorganic world are secondarily derived through the activity of living matter.

Living generation is the sole primordial effect of nature, and it cannot be produced by propagation of movement or mechanical derivation; it is the original or primordial change from which the continuous perturbation of physical cosmos is derived. Living matter cannot change its physico-chemical state as can matter which is not alive; it has a special structure or organization which can only be formed by organic generation. The multiplication of living beings is really an incomprehensible procreation which cannot be produced by mechanical propagation, as the inorganic world continually experiences a loss of living force which is repaired by organism, thus determining the conservation or persistency of material change in the universe. Thus we have explained planetary movements, gravity, and terrestrial magnetism, by progenic impulsions arising from the difference between the periodical changes in vegetable and animal organisms, and also from the difference between both organic kingdoms during the day and night, and we have also explained the photothermic propagation of sunlight, not by solar combustion, but by the interference of the heat radiated from all the planets to the surface of the sun which is situated in the focus of their orbits.

Vitality is the proximate effect by which all the material changes of the world are directly originated; all the changes of inorganic matter are secondary effects, and serve as a medium for the development of organic matter. The functional synthesis of organism or vitality is then the proximate cause of the uniformity of nature, that is to say, of the persistent uniformity with which the material mutations or operations of nature are effected; this means the constant succession of material manifestations or phenomena whose differences are in fact very gradual and not sudden. But the cause of the elective capacity of generation is a complete mystery, which can only result from the direct influence of the Supreme Motor, the Supernatural Subject which we admit and recognize only by its effects.

We must also recognize as metaphysical or immaterial activity the mental subject whose process is inexplicable by the acts of mechanism, its characteristics being differences of quality and therefore very different from the characters of movement, which is always the same in its qualitative attributions—substance and activity. We conceive the mind by the attribute of its own consciousness, and mental acts may be only related to time without our being able to predicate of them any phenomenal activity, that is, any change directly appreciable by the senses, and any relation of space; while the object or material being has as a constant and indispensable characteristic the predicate of extension, which implies attribution not only of material substance, but of movement, and relation not only of space, but of time. In reality we can perceive an evident distinction between the material and the mental: the material is inert according to the principle of conservation, and is known by the relations of space and time or predicates of quantity, while the mental is active and is known by the attributions of differential activities or predicates of quality. In the material changes of mechanism the antecedents and consequents are equivalent, there is neither creation nor annihilation of anything (conservation of energy = inertia of matter), while in mental process the general conclusions are not equivalent to their antecedents, as they comprehend the universal concept of all cases of the same kind though we can never observe more than a limited number; inductive thought, then, creates some ideas in contradistinction to inertia of matter. Material differences have mathematical reason, as changes of matter are propagations of movement expressed by quantitative differences or relations of space and time, connoting identity of (qualitative) attribution, that is, substantial identity and identity of activity—motion; while mental differences have no more reason than the states of consciousness (different kinds of perceptions); these qualitative differences of activity are inexplicable by propagation of movement, and in them we cannot determine relations of space. The knowledge of mechanical or physiological changes must be acquired by means of experience or observation; it cannot be reached by pure reason alone; while the knowledge of the mental process can only be known by our own conscious activity which is not manifested to the senses.

Fourth Conclusion.

§ 67. MATTER IS AN ACTIVE SUBSTANCE, BUT ITS ACTIVITY IS OF COURSE DERIVED.

Irreflexive experience distinguishes matter and force as separate things, and these mental abstractions give rise to the erroneous concept of matter current among physicists. Objects are not aggregates of matter and force, neither are inorganic bodies aggregates of mass and movement, nor are living bodies formed by the aggregation of protoplasm and irritability. A body, even a living one, is in reality one thing alone; such terms as "matter" and "force," etc., represent, not different things, but only the ultimate notion of objective attributes. Hence there are no such things as force, movement, and irritability in the sense of abstract or causing agents which can determine the changes of nature.

Any material thing or object is necessarily a substance in activity—movement, whose measure is called force, and whose differences depend on variable relations of space and time. Force, then, only represents the measure of the movement which is constantly propagated throughout the world, and is but a mechanical resultant in accordance with the principle of conservation. Forces, we repeat, are not abstract agents or primordial powers; they represent the resultant measure of the movements of matter which are natural effects mechanically derived, and which are constantly changing in the world, without creation or annihilation, in accordance with the evident fact of inertia of matter, that is, always preserving equivalent energy in their propagation. But this affirmation would not be true if by force we meant (like many writers) the product of half the mass (quantity of ponderable matter), and the square of the velocity, for such a product is not the same throughout the incessant mutations of nature; we must include in the total quantity of mechanical power or force the potential or non-manifested state of material energy which results from some progenic movements. Accordingly, abstract causing or generating forces in nature, as attraction and repulsion, which are the remains of the supreme *anima mundi* of the ancient philosophers, must no longer be admitted, the word "force" always signifying in science the measure of the effects of propagated movement. If sometimes we do not discover direct propagation in a change, it is because there is indirect transmission through a medium which is not constantly manifested, and in order to explain this, we must now briefly express our ideas on the constitution of matter.

Matter is not continuous in extension, it could not move if all space were absolutely full; there must be diminutive spaces relatively void among the smallest particles which constitute matter. Ponderable matter is formed by invisible and indivisible corpuscles, which are separated from one another, either totally or partially, leaving the spaces we call porocules. Atoms have no determined properties, and therefore they are not what the chemists suppose them to be—the determined equivalents of combination, nor what is determined by what they call atomic weights and volumes ; nevertheless, in the phenomena of nature, especially in chemical metamorphoses, we see sufficient reason to admit atomic constitution of ponderable matter, though we do not recognize the atom as an object of fixed determinations.

The atomic interstices of bodies contain imponderable matter or progene, but this does not fill such porocular spaces in absolute but only relatively, because it is always in oscillation, and thus it serves as the universal medium for the interaction of atoms when these are not in contact. The gradual interchange in the propagation of progenic movements, which may be mutually transferred according to the most variable proportions without fixed relations, like those of atomic changes, conduces us to the belief that progene must exist in very variable parcels in the interstices of bodies.

Not only are atoms of the same qualitative nature, but atoms and progene must be identical, except in their density, this difference being, if we take the atom as the unity, as 1 : 0·54. Differences of matter, then, are only quantitative, inferring this from the mutual quantivalence of progenic transferences into molecular, and molar changes, and *vice versâ*.

Progene cannot change in its physico-chemical state; it is always a metafluid which is distributed in very variable parcels, so that it cannot form different kinds of irreducible or non-convertible objects as ponderable matter may, on account of the geometrical differences of its invariable or indivisible atoms. Although we have made a distinction between interstellar and interstitial progene, such denominations do not mean that the progene in one condition cannot change place with that of the other; on the contrary, interstellar and interstitial progene are in constant mutual interchange.

We have rejected the idea of the inherence of any properties in matter, such as elasticity and movement, and we have also rejected the inherence of causing forces like the hypothetic attractions—affinity, planetary attraction—and the hypothetic repulsion of matter, engendering heat by means of molecular vibration, and we have set aside, too, the existence of different imponderable fluids, as luminous, electric, magnetic, and nervous fluids. In all these cases we admit the intervention of the medium we call progene, whose real existence must be recognized, although it is neither tangible nor ponderable. The affirmation of the existence of such a metafluid is a necessity in science, in order that reason may explain the mechanism of the world in general and that of living bodies in particular; its existence cannot be denied, because interstellar changes suppose propagation of movement, and if interstellar space were empty, nothing could move in it; consequently there must be some matter in movement there serving as a medium. Thus, also, when the diminutive particles of a body are approximated and separated in order to produce different molecular changes, we must admit something that impulses the molecules to the execution of their movements. Besides, such an all-pervading substance is directly felt by the eye as light and by the ear as sound.

The first change of movement or generation of living energy in universal mechanism takes place in progene in order to determine the molecular and molar changes of organic generation. But to effect this the intervention of a power superior to mechanical propagations is necessary, as mechanism in all its changes dissipates living energy, which is constantly repaired by the said act of generation. So that progene, in accordance with its etymological meaning, is the first-engendered substance, or the primordial existence in mechanism, and by its means we can explain all the changes which are apparently effected by physical agents, as attraction and repulsion, erroneously supposed to be forces acting at a distance. Furthermore, progene conceived under different forms of movement, perfectly explains all the potential states of nature, which in non-living bodies, are denominated latent and radiant heat and electricity, and which in living bodies we have denominated protogenition, biotension, and innervation.

We can also very well conceive the formation and different characters of inorganic bodies by the union of atoms and progene. Thus, when the energy of the interatomic progene of a body is greater than that which acts in external pressure the body is in a fluid state, and on the contrary, when the energy of interstitial progene is less than the progenic pressure gravitating outside the body a solid state results. A liquid is no more than a gas reduced by molar pressure to its minimum capacity.

Bodies in their physical state may be either incomplex or complex, the greatest complexity on earth resulting in living matter, whose formation we cannot explain by the simple combination of atoms and progene; it cannot be mechanically constructed like inorganic bodies. From what has been said the physiological analysis of the constitution of cosmos shows us ery different states of matter which may be more learly seen in the following table :—

norganic bodies.	Metafluid state—progene alone.	In unbroken continuity		=Interstellar progene.
		In minute parcels		=Interstitial progene.
	Corporeal state—atoms and progene together.	Fluids.		Gases.
				Liquids.
		Solids.		Symmetric.
				Asymmetric.
Organic bodies.	All states of matter together.	Primordial		=Protoplasm.
		Derived	from protoplasm.	Organic nuclei.
				Organic cellulæ.
			from cellulæ.	Organic fibres.
				Organic membranes and tubes.

Accordingly, in all which is the object of sensual observations there is no unity ; in the physical world irreflexive experience finds plurality as in the immensity of the universe we see scattered innumerable stars and planets, among which is the planet we inhabit ; on the earth we observe many different kinds of bodies which we classify as organic and inorganic, and among the last there are many different persistent substances which are considered as simple or elemental because they cannot be decomposed nor are they chemically convertible or reducible to one another. Nevertheless, here are sufficient rational proofs to affirm that qualiative nature—substance and activity—is always the ame in all objects, and that objects differ only in their uantitative relations—space and time.

Fifth Conclusion.

§ 68. MATERIAL CHANGE IS BUT PROPAGATING MOVEMENT.

We have said that cosmic mechanism, that is, physiological object, nature properly so-called or the material world, is an abstract conception of matter in movement. In truth, all the changes of matter, potential as well as phenomenal, must be explained by movement, either visible or invisible, this last not being manifested, but beyond the reach of our senses on account of its minuteness. If all changes of matter, potential and phenomenal, always consist in changes of place and then at bottom all are movement, their differences are only quantitative, that is, differences in the relation of space and time; but the manifestation of movement or phenomenal condition of change is different for every sense according to its perceptible factors, and from this arises the qualitative classes of sensations, although among all their originating movements there can be only qualitative identity. In reality, movement, which is the sole form of material activity, can differ only in its quantitative relations, and therefore the so-called qualitative differences of matter are merely subjective or ideal ; they can never be objective or material. All physiological change implies propagation of movement, which first becomes manifested in living bodies in the genesic acts of vitality in the collocation of material in order to form the organic structures ; all the other changes of cosmos are afterwards determined by the transference, or, better to say, by the propagation of such genesic movement.

Our final aim in this Theory of Cosmos is to explain correctly the material circulation in the world by propagation of movement, in a way contrary to the present doctrines, which pretend that the original centre of such a circulation on the earth is solar combustion ; but even if it were true that the sun was persistently burning, it would still be a fact that a thermochemical change s a derived and very secondary one, and although this kind of change is the first manifested in cosmos, we must admit and recognize in nature the priority of some potential progenic energy which is necessary to impulse the molecules to produce the primordial metamorphoses of living matter. But as organic generation is a mysterious, supreme fecundation, the remote or primordial cause of all manifested changes (including solar light, gravitation, terrestrial magnetism, and planetary movements) acts upon cosmos, using organism as the sole medium.

Let us now see how Physiological Theory must explain the successive evolution of material changes, or, better to say, the involution of cosmos. The first manifestation in the world is trophic or nutritive function, and so chemical changes are primarily effected in the act of organic collocation. From this perturbation all the material changes which we can discover in living as well as in non-living matter are derived. Thus, the progene necessary for moving atoms to the formation of organic structures and preserving them in such a complex condition is freed when the decomposition of such structures takes place; and then the progene that was before static—potential state which we call biotension, becomes dynamic, either in oscillation as heat, or n a confined course through the nervous conductors as nnervation. The propagation of oscillatory movement through interstitial progene increases the force whose effects appear to be the result of molecular repulsion, and then there may be either increase of temperature, or change of physical state, or else another chemical decomposition may take place. As the propagation of oscillatory revolution of progene through the interstitial parcels of all bodies constantly occurs the effects of an apparent repulsion of the ponderable particles are produced, and for this reason some degree of heat always exists in all objects. Heat may be propagated either by conduction or by radiation; the radiating heat which is propagated from all planets is reflected by all celestial bodies but principally by the sun, in which the interference is sufficient to determine the photothermic radiation called sunlight. This motion of interstellar progene is propagated through the atmosphere in two different ways because some of the progene collides with the atoms of the atmosphere and propagates to these some concentric or centripetal movement from which atomic gravitation results, while the progene which passes through the interatomic spaces continues in its diffuse propagation as light. In this manner all the parts of the earth, including the atmosphere, are under the pressure of ultra-atmospheric progene, which produces the force called gravity; and this apparently determines in corpuscles and bodies the effect of a centripetal attraction in proportion to the mass and the square of the distance. Heat and gravity then act as opposing movements from which the so-called forces of attraction and repulsion result. The two usual ways of manifesting atomic gravitation are by the so-called forces of cohesion and affinity; the first is referred by the authors to homogeneous corpuscles, and the second to those which are heterogeneous and which may combine in definite proportions. In chemical metamorphoses all kinds of movements or material changes may be evolved, which in the correlative order of their frequency may be mentioned as follows: (1) oscillatory movement which, as we have said, produces heat; (2)

progenic currents confined in conductors which may be either living nerves or inorganic matter, principally metallic wire; in the first case we call the current innervation, and in the second dynamic electricity; (3) diffuse radiation of progene which may impress the retina and produce the sensation of light; and (4), in chemical reactions progene may become freed in such a manner as to produce the explosion of a body, whose particles thus coming into vibratory movement, and whose progenic parcels coming into condensed oscillatory movement, may propagate this progenic motion to the ear and produce the sensation of sound. Any one of the forms of invisible movement, but especially heat, is frequently transferred into visible movement or molar work both in animal economy and in machinery; among these works the principal are locomotion, orbital and rotatory movements of the earth as of the other planets, terrestrial magnetism, and gravity. The periodical increase and diminution of gravity alternating every six hours is very remarkable, and this, like the other planetary phenomena, directly depends on the periodical changes of organism, which varies in its activity twice every twenty-four hours, according as it is day or night. Besides, the vegetable world generally varies twice every year according to the seasons, and this also produces some changes in gravity. Thus, some material acts, which at first sight or to irreflexive observation appear to be far removed from a possible interpretation, show to reason analogies with the work seen in the simplest machine. Accordingly, the circuit of change in the Cosmic System is closed, not by a mechanical propagation like combustion, but by living generation, in which there must be the immediate intervention of a Supernatural Power in order to generate living force; this is first manifested by the functions of living matter, which afterwards propagates its action to the inorganic world, where the living energy is dissipated by the gravitating resistance of atoms, until it is newly manifested by the protomotion of vitality—protogenition.

Sixth Conclusion.

§ 69. MONOTHEISM MUST BE PROCLAIMED IN PHYSIOLOGY, THUS REJECTING ALL ABSTRACT FORCES IN NATURE.

We have recognized the constant generation of change in material activity—motion—with conservation of energy, and we have admitted one, and only one causal determination in accordance with the unity of the system, because we must reject abstract or causing forces, and also atomic unity throughout nature.

The doctrinary physiological error most commonly upheld by physicists is realism, they taking for granted that the ontological abstractions of passive substance, and, above all, of abstract or causing forces are real existences. In the fundamental definitions given by most authors such ontological realizations are expressly admitted, as may be seen in their definitions of the words attraction, repulsion, gravity, affinity, cohesion, and so on. Such definitions show that authors suppose that invisible particles and great masses are endowed with attractive and repulsive forces which determine all material changes. The so-called hypothesis of universal attraction is both imaginary and absurd; it is a fallacy of language; still more it is the name of nothing, because the existence of an attractive force acting at a distance is an impossibility. To admit attraction among invisible particles and great masses is an incomprehensible absurdity. To explain gravitation, chemical combinations, cohesion, etc., by the enigmatic mutual attraction of matter is in complete contradiction to the true fact of inertia of matter and the law of conservation, because attraction means constant creation of force or mechanical power as a continuous source of movement, and if there was really such a thing as attraction matter would be the generator of energy instead of being inert. For this reason we supplant the phrase "universal attraction" by that of "atomic gravitation," as we notice that those changes in which matter acts as if mutually attracted take place only in atomic or ponderable matter.

In order to explain the changes in which objects act as if they were in repulsion, and also to explain the reparation of living force in mechanism, most authors admit elasticity, or, what is the same, an inherent movement, rotation, for instance, in matter, which determines elasticity. There is no property or action inherent in matter, and this is confirmed by the study of Special Analytic Physiology (see "Theory of Physics"), where all phenomena and the other changes of nature are explained without the intervention of elasticity as a causing force. Elasticity is a movement which appears to be a reaction of bodies to recover their dimensions when these are changed by some force whose action has disappeared. Such an apparent inherence of abstract or causing force in bodies depends on progenic oscillation, or, better to say, is a resultant of the relative interaction of progene and atoms, and this resultant is variable according to the relative disposition of these constituents; thus fluids react, manifesting great elasticity of expansion when the pressure to which they are submitted decreases; while most solids react in a very defective manner when their dimensions are changed by some external pressure or traction; and among those solids in which elasticity is more noticeable we observe reaction in two different forms, one instantaneous, and the other vibratory.

Accordingly, elasticity is not a property inherent in matter; it is an objective condition which cannot be absolute but relative, and, therefore, it is erroneous to pretend that it can be the cause which repairs the dissipation of living force in cosmos. We may say the same of the relativity of all other properties which are considered by most authors as inherent to material elements such as movement, extension, and impenetrability, and which like elasticity are relative conditions resulting from the intermotion of progene and atoms according to their aggregation in bodies. It is not only unnecessary for science, but also far removed from our understanding to recognize causing or abstract forces in matter; we do not need to and must not admit attraction among celestial bodies, nor must we admit the molecular forces of cohesion, adhesion, and chemical affinity, nor any vital force apart from the Supreme Generator, and hence, such enigmatic hypotheses as those of attraction and repulsion must be supplanted by the rational idea of the production of material change by the propagation of movement, either by direct impulse, or through intermediary or indirect contact of progene from molecule to molecule, as well as from star to star.

When Physiology tries to explain evolution of nature, it concerns itself only with secondary effects or deuterogenic changes, and does not study the cause of the change which is engendered in a primordial manner. The problem of the generation of change, which consists in the production of living force by means of potential energy, is irresoluble by mechanism, as it is more distant from realization than the production of continuous movement in a machine. Here we have precisely the mystery, the superhuman, whose agency, although imperceptible by the data of the senses and by intrinsic intuition, the light of our reason admits and names by many words as the Divine, the Omnipotent, etc., and whose power is capable of engendering the continuous change of cosmos acting upon organism according to the formula $r > f$, that is, manifested resultant greater than living force employed. In spite of this truth many writers distinguished for their scientific descriptions have cynically affirmed the philosophic error that belief in a God is always a refuge of ignorance. This needs no higher commentary than simple reasoning, which at least is not controlled by the mental pride which makes such men presume that there is nothing in the universe which can resist their penetrating vision, and from this they draw their final conclusion that "nothing exists outside the dominion of the senses!" But, on the other hand, they justly accuse religious beliefs in having frequently served as a mask for ignorance. Who doubts that it is a superstition to refer directly to the Creating Cause or Prime Motor any material or mechanical change which is operated in conformity with the formula $r < f$? These are natural changes produced simply by propagation of movement. But in such a superstitious reference an error of succession has been committed by taking the remote cause for the proximate, yet this is of no such consequence as and much more excusable than to deny the Generating Cause and suppress the concept of succession, after the manner of atheists.

Again, irreflexive experience and the realization of ideas in the order of their acquisition and teaching, has conduced many writers to imagine that life results from the union of mechanical forces, and they give no other reason for this idea than that every one of the changes of organism is also produced in the inorganic world. In this manner the observed facts of cosmos, which are, of course, relations, and therefore descriptive, are considered by renowned writers as genesic; such is the error of the conception of Laplace concerning the evolution of the solar system, and of all the ideas of modern evolutionism and transformism. Any transformistic doctrine is not an advancement from the indefinite towards the definite, it is purely a phenomenal description of nature—a graphic representation of the world to the senses—but it does not genesically explain anything; it does not teach us to reason out the process of causality.

Universal effects are of two kinds, spiritual and material; the spiritual are the subject of direct perception, and the material are the objects perceived, not directly, but by the interaction of the senses, both with the external world and the mind; but the Primordial Cause of all effects in the universal system is one alone which is neither subject nor object of perception in our mind, but is truly the Creator and Generator of all we perceive. Nevertheless, the existence of God, mind, and matter are inconceivable as really independent of or separate from one another—that is to say, our understanding can only hold the ideal abstraction or nominal independence of any of the said entities; we cannot truly comprehend a real being which could be cause without effect, nor mental subject without material object, or *vice versâ*, comprehending, of course, in this concept of universal dependence the mechanism of life as well as that of the whole cosmos. For this reason the traditional truth of Christian revelation of the separate existence of God, soul, and body is and always will be a complete mystery, inexplicable by words and impenetrable to the intelligence. The problems belonging to this transcendental Trinity are beyond the limits of Physiology; they belong to Metaphysics.

Physiological explanations can never pass from the numerical equivalence of correlation between antecedents and consequents, but this is not to assert that we find tenable the pretended scepticism of those who affirm that there is a complete mental satisfaction of causality by determining in numbers the relations of cosmic effects. Perhaps this may satisfy some minds, but it cannot satisfy minds privileged with such intellectual development as to be able to reach the contemplating concept of a Supreme Cause, although this may be only admitted and recognized by the attributions and relations of the created, principally by the organic and psychic activities which are multiplied and developed in the universe. No substantial predicate nor relation in space and time can be referred to the Creator, as we cannot have any concept of perfection more than the material and the mental; God is inconceivable as He cannot be either the one or the other, and at the same time must contain the capacity for both. To the

Supreme Intelligence, as to any human intelligence different from our own mind, we cannot make reference more than in its activity, and this is revealed to us by the government of the whole universal system through organic generation.

SUMMARY OF DEFINITIONS.

A. DEFINITIONS REFERRING TO THE "INTRODUCTION."

Subject in Philosophy (Physiology and Metaphysics) means the knowing principle—*ego, mind,* or *spirit*—that is, the abstract idea of that which perceives sensation and elaborate thought. Subjective or mental activity is known only by self consciousness, which perceives differences of qualities, and not by the senses, as it cannot be submitted to experimental proof.

Object in Philosophy (Physiology and Metaphysics) is the opposite term to mental subject, and therefore means all sensual things together—*non ego, matter,* or *nature,* that is, the abstract idea of that which is known by experimental data. Objective or material activity is known by extrinsic propagations from which the mind can only perceive differences of quantity.

Sensations may be grouped under two headings—subjective and objective sensations. *Subjective sensations* are referred to the intrinsic states of the mind—intuitions, which may be either emotional or instinctive.

Objective or proper sensations are referred to the extrinsic states of the material things which propagate their activity or movement to the mind, and are acquired by means of the special senses. These special or objective sensations we divide into two kinds—immediate and mediate.

Immediate objective sensations are touch of pression, taste, and smell, which, in order to be produced, need the direct contact of ponderable matter with the senses, it being worthy of notice that solids are the best to determine the sensation of pression, liquids of taste, and gases of smell.

Mediate objective sensations are thermic touch, hearing and sight, which are regularly produced by objects separated from the senses, to which movement is then propagated by means of imponderable matter or progene.

Physiology in its original and etymological meaning is the science of nature, matter, or object, and its first data are the special sensations which constitute our experience or sensual observation. This is the sense in which we employ the term Physiology, which we divide into Abstract and Concrete, subdividing Abstract Physiology into General and Special.

General Physiology concerns itself with the abstract study of nature, that is, with the *Physiological Theory of Cosmos*, which does not treat in particular of the knowledge of every physical or physiological change.

B. CONCEPT OF MATTER.

Conceptual elements are the abstract terms which represent the ultimate analytical notions of things, namely, substance, activity, space, and time.

Material substance is the conceptual term used to represent the ultimate abstraction of all the names of real objects, that is to say, the nominal concept common to all things perceived by the senses with the elision of their activity, space, and time.

Material activity (abstract movement) is the conceptual term used to represent the ultimate abstraction of all attributive predicates which are applied to real objects, that is to say, the predicative concept of all things perceived by the senses, with the elision of substance, space, and time.

Space is the conceptual term used to represent the ultimate abstraction of all relative predicates regarding the extension of real objects and their distances, elision being made of substance, activity, and time.

Time is the conceptual term used to represent the ultimate abstraction of all relative predicates regarding the duration of objective changes, elision being made of substance, activity, and space.

Extension is not an absolute property of matter, but a quantitative determination of the space occupied by bodies according to the relative movement of their constituent elements.

Impenetrability is not a property of matter; on the contrary, it is practically impossible to reduce bodies to their minimum extension, and we do not know even theoretically what could be the limit of penetrability of bodies.

Essence of matter or *qualitative nature of objects* is always the same throughout the world, as objective sensation results from propagation of movement, and this can only differ in quantitative relations—those of space and time.

Force is not an abstract or causing agent, but simply the measure of material activity—movement.

The notion of material existence or object (concrete things in motion) comprehends the four elemental concepts: the two attributive concepts, substance and activity, which are called also essence or qualitative nature, and the two relative concepts, space and time, called also contingencies or quantitative connections. These last—the relations—are the only ones to be considered in natural or physiological differences, as the qualitative differences depend on the reaction of our mental subject.

Realism is the erroneous doctrine which admits the ontological realization of the conceptual elements either separately or combined, and therefore it considers abstract ideas as realities.

Idealism is the erroneous doctrine which admits only the ideal conception of all things, even of those which are active substance existing in space and changing with time, and therefore idealism considers the concrete existence of objects as mere ideas.

Monistic doctrines have as a fundamental error either realism or idealism; thus materialism, atomism, and transformism are realistic doctrines, and pure dynamism is also in some measure realistic.

Universal attraction is supposed by most authors to be a force or tendency of matter to approximate the parts which are separated; but there is no possibility of the existence of such a thing as attraction, and it is still more contrary to fact to consider it as a universal property.

Physiological change is a different mode in the manner of being of objects, and so it is only a variation in the quantitative relation (space and time) of matter in movement.

Inertia of matter means that physiological change is never a new creation, and is never annihilated, but only a variation in the form of propagated movement, and hence inertia is technically equal to conservation of energy in the world, which signifies that in physiological transformations the same quantity of matter in movement is always preserved.

Physiological cause represents the nominal abstraction of all the conditions necessary to effect any material change; the word *cause*, then, in Physiology, has only a relative meaning.

C. PONDERABLE MATTER.

Mass is the quantity of ponderable matter which bodies contain, and is determined by weight, which, like any other force, is a variable and not a fixed relation.

Atoms are the most minute or indivisible particles of ponderable matter which are identical in their attributions and density, and differ from one another only geometrically, that is, in volume and perhaps in figure.

Atomic weights and *volumes* represent the proportional quantities in which bodies enter into chemical combinations, but they do not represent any determined weight and volume of atoms.

Molecule is the common term used to represent all the concepts of invisible particles whether divisible or not. Molecules, then, may be either simple or compound; simple or elemental molecules are the atoms, and compound molecules are polyatomic particles in which the elements may be either incomplex or complex.

Chemical molecule is the concept of a particle containing the proportional though indefinite number of atoms in which bodies are combined.

D. PROGENE = IMPONDERABLE MATTER.

Progene is the all-pervading imponderable matter which relatively occupies all space void of ponderable matter, and its density is about half that of atoms (as fifty-four is to one hundred).

Progene occupies both *interstellar* and *interstitial* space; in the first case it is in unbroken continuity, and in the second it is distributed in very variable parcels throughout the porocules of bodies. Interstellar and interstitial progene are in constant interchange.

Progene may be either in a *potential* or *phenomenal* state, this difference resulting from the impressionability of our senses to notice the changes of its persistent movement.

Progenic potence results from the non-manifested changes of progene which are infra- and ultra-sonorous oscillations, infra- and ultra-luminous emissions, and static and dynamic electricity.

Progenic phenomena are the manifested changes in which progene only is in movement; this movement may be either oscillatory—propagation of sound, or translatory—propagation of light.

E. CONCEPT OF BODIES IN GENERAL AND OF INORGANIC BODIES IN PARTICULAR.

A *body* is a limited portion of ponderable matter containing in its atomic interstices (porocules) variable parcels of progene.

Bodies may be either *inorganic* (cosmic medium) or *organic* (living and dead matter), or else *mixed* bodies—aggregates of inorganic and organic matter (planets).

Inorganic bodies are classified by their physical consistency and by their chemical composition; by the first concept (physical states) bodies are either solids or fluids, and by the second (chemical states) they are either simple or compound.

Physical states result from the relative proportions between the internal energy of bodies which is determined by oscillating progene or heat and the external energy which is determined by gravity.

Solid states, whether asymmetric or symmetric, result from the preponderance of the external or gravitating energy over the internal or thermic, and

Fluid states, whether liquid or gaseous, result from the preponderance of thermic energy over gravity.

Gas is the most simple state of bodies, because they have their atoms separated from one another; and it is the regular state of all fluids when they are not under the pressure of some other body.

Liquid is an intermediary state between gas and solids, and results from the reduction of gas by molar pressure to its minimum extension, thus equilibrating the excess of internal action, and producing the union of atoms two by two (hydrocules).

Symmetric solids or *crystals* when fractured show plain surfaces which present constant incidences among themselves, and therefore they are constituted by symmetric, polyhedric particles—regular orocules.

F. CONCEPT OF ORGANIC BODIES.

Organic bodies are highly complex structures of living matter, and are also those structures which, although dead, still preserve the morphologic appearances which they showed during life.

Characters of organic matter there are none but the manner of being engendered, and therefore we practically recognize this only because we cannot fluidify organic matter without destroying its structure, which cannot be reconstructed by any industrial means, not even by chemical combination.

All definite compounds, even those complex compounds of carbon which can undergo either fluidification or decomposition, and which in either case can be reconstructed by industrial means, must also be called inorganic bodies like those included at present in works on Inorganic Chemistry.

Protoplasm is the simplest organic matter of granular, homogeneous, and semi-solid appearance, from which all the other organic forms, as nuclei, membranes, and fibres are derived.

Vitality is the synthesis of all the functional changes which are operated in living bodies.

All functions after an ultimate analysis are nothing but material changes like those observed in the inorganic world, and they may be classified as potential and phenomenal.

Potential functions are changes not manifested to the senses; they are only inferred by reason, which sees the necessity of admitting some progenic movements in living bodies, in order to determine their acts of protogenition, biotension, and innervation.

Protogenition is the progenic movement necessary for the changes of collocation of ponderable matter in the acts of organic generation—nutrition and reproduction.

Biotension is the static progene which is confined in the organized particles, and which is manifested under different forms, principally by heat in the decomposition of organic matter, and by visible movements in muscular contractions.

Innervation is a confined current of progene running through the nerves, and hence is but electricity propagated through living conductors.

Phenomenal functions are manifested changes which may be either partial movements of invisible particles—nutrition, or total movements of visible parts—reproduction and contraction.

Nutrition or *trophic function*—assimilation and dis-assimilation — is a complex molecular movement or thermochemical phenomenon, and consists in endothermic metamorphoses or reductions and exothermic metamorphoses or oxidations. The thermochemic changes of reduction predominate in green vegetation, and those of oxidation in animal life.

Reproduction is the total movement of a visible organized particle which is separated by self-excision in order to take on an individual existence like its parents or other ancestors.

Contraction or *contractility* is also a visible movement, but a returned one, in which protoplasm in general, principally the muscular, is alternately reduced and relaxed.

Cellule is the common concept of all organized, visible particles, elision being made of their anatomic forms and peculiar functions; so that the elements which have acquired the most complex development are imaginarily deprived of their derived parts as nuclei, membranes, and fibres, and also imaginarily deprived of all living functions except nutrition, which is the primary and sole manifestation common to all living bodies.

[Although reproduction is, like nutrition, a manifestation common to vegetable and animal species, it is not a function of all organisms, many being sterile.]

Irritability as the cause of living functions or cellular activity is an inadmissible agent, and, as an effect, would be an improper denomination for vitality, and therefore it must be omitted from scientific terminology.

G. CONCEPT OF PLANETARY BODIES.

Planets are bodies constituted of organic and inorganic matter. Living organic matter is the proximate agent of planetary movements, for which non-living bodies are only the cosmic medium.

The *sun* is not a body in combustion ; it is principally a great reflecting mass, which, situated in the focus of the orbits of many planets, reflects their infraluminous emissions, these producing light by their conglomeration.

The *rotatory movement of the sun* is accomplished in twenty-six days, therefore there must also be some living matter in the sun.

Natural light or *daylight* is a photothermic radiation produced by transference, not only of the radiating motion of the planets, but also of the motion engendered by solar living beings.

The sun principally differs from the planets in that having but one and relatively small continent it cannot sensibly come into any orbital revolution.

Satellites must also be constituted of organic and inorganic bodies, and they revolve towards the planets because the progenic energy which they receive from their corresponding planets is greater (on account of their proximity) than that which they receive from the sun.

H. COMPREHENSIVE CONCEPT OF THE UNIVERSE.

The *universe* is not only an aggregate of all the planetary systems, but there is besides some cause apart from matter acting as its governor or Prime Motor.

Periodicity of phenomena or manifested energy in the universe results from the alternating increase and diminution of the intrinsic and extrinsic changes of organism; vitality thus being the primordial effect of the Supreme Motor.

Cosmogony—the science of the formation of the universe, and of the cause of the conservation of the world in its actual state—is not a physiological doctrine; it is a matter of pure belief which is beyond any experimental proof, and therefore it enters into the province of Theology—a metaphysical science.

PRINTED BY WILLIAM CLOWES AND SONS, LIMITED, LONDON AND BECCLES.

A LIST OF

GAN PAUL, TRENCH, TRÜBNER & CO.'S
(LIMITED)

PUBLICATIONS.

7.90.

57 and 59, Ludgate Hill; and 1, Paternoster Square,
London.

A LIST OF

KEGAN PAUL, TRENCH, TRÜBNER & CO.'S
(LIMITED)

PUBLICATIONS.

CONTENTS.

GENERAL LITERATURE . . 2
THEOLOGY AND PHILOSOPHY. 31
ENGLISH AND FOREIGN PHILOSOPHICAL LIBRARY . 42
SCIENCE 44
INTERNATIONAL SCIENTIFIC SERIES 48
ORIENTAL, EGYPTIAN, ETC. . 52
TRÜBNER'S ORIENTAL SERIES 68
MILITARY WORKS. . . 72
EDUCATIONAL . . . 73
POETRY 80
NOVELS AND TALES . . 84
BOOKS FOR THE YOUNG . 87
PERIODICALS 88

GENERAL LITERATURE.

Actors, Eminent. Edited by WILLIAM ARCHER. Crown 8vo, 2*s.* 6*d.* each.

I. **William Charles Macready.** By WILLIAM ARCHER.

II. **Thomas Betterton.** By. R. W. LOWE.

ADAMS, W. H. Davenport.—**The White King**; or, Charles the First, and Men and Women, Life and Manners, etc., in the First Half of the Seventeenth Century. 2 vols. Demy 8vo, 21*s.*

AGASSIZ, Louis.—**An Essay on Classification.** 8vo, 12*s.*

ALLIBONE, S. A.—**A Critical Dictionary of English Literature and British and American Authors.** From the Earliest Accounts to the latter half of the Nineteenth Century. 3 vols. Royal 8vo, £5 8*s.*

Amateur Mechanic's Workshop (The). A Treatise containing Plain and Concise Directions for the Manipulation of Wood and Metals. By the Author of "The Lathe and its Uses." Sixth Edition. Numerous Woodcuts. Demy 8vo, 6*s.*

American Almanac and Treasury of Facts, Statistical, Financial, and Political. Edited by AINSWORTH R. SPOFFORD. Published Yearly. Crown 8vo, 7*s.* 6*d.* each.

AMOS, Professor Sheldon.—**The History and Principles of the Civil Law of Rome.** An aid to the Study of Scientific and Comparative Jurisprudence. Demy 8vo, 16*s.*

ANDERSON, William.—**Practical Mercantile Correspondence.** A Collection of Modern Letters of Business, with Notes, Critical and Explanatory, and an Appendix. Thirtieth Edition. Crown 8vo, 3*s.* 6*d.*

ANDERSON, W., and TUGMAN, J. E.—**Mercantile Correspondence.** A Collection of Letters in Portuguese and English, treating of the system of Business in the principal Cities of the World. With Introduction and Notes. 12mo, 6*s.*

Antiquarian Magazine and Bibliographer (The). Edited by EDWARD WALFORD, M.A., and G. W. REDWAY, F.R.H.S. Complete in 12 vols. £3 nett.

ARISTOTLE.—**The Nicomachean Ethics of Aristotle.** Translated by F. H. PETERS, M.A. Third Edition. Crown 8vo, 6*s.*

ARMITAGE, Edward, R.A.—**Lectures on Painting:** Delivered to the Students of the Royal Academy. Crown 8vo, 7*s.* 6*d.*

AUBERTIN, J. J.—**A Flight to Mexico.** With 7 full-page Illustrations and a Railway Map of Mexico. Crown 8vo, 7*s.* 6*d.*

Six Months in Cape Colony and Natal. With Illustrations and Map. Crown 8vo, 6*s.*

A Fight with Distances. Illustrations and Maps. Crown 8vo, 7*s.* 6*d.*

Australia, The Year-Book of, for 1889. Published under the auspices of the Governments of the Australian Colonies. With Maps. Demy 8vo, 10*s.* 6*d.*

AXON, W. E. A.—**The Mechanic's Friend.** A Collection of Receipts and Practical Suggestions relating to Aquaria, Bronzing, Cements, Drawing, Dyes, Electricity, Gilding, Glass-working, etc. Numerous Woodcuts. Edited by W. E. A. AXON. Crown 8vo, 3*s.* 6*d.*

Bacon-Shakespeare Question Answered (The). By C. STOPES. Second Edition. Demy 8vo, 6*s.*

BAGEHOT, Walter.—**The English Constitution.** Fifth Edition. Crown 8vo, 7*s.* 6*d.*

Lombard Street. A Description of the Money Market. Ninth Edition. Crown 8vo, 7*s.* 6*d.*

Essays on Parliamentary Reform. Crown 8vo, 5*s.*

Some Articles on the Depreciation of Silver, and Topics connected with it. Demy 8vo, 5*s.*

BRADSHAW—continued.

A B C Dictionary of the United States, Canada, and Mexico. Showing the most important Towns and Points of Interest. With Maps, Routes, etc. New Edition, Revised. Fcap. 8vo, 2*s.* 6*d.*

Bradshaw, Henry: Memoir. By G. W. PROTHERO. With Portrait and Fac-simile. Demy 8vo, 16*s.*

BRENTANO, Lujo.—**On the History and Development of Gilds, and the Origin of Trade-Unions.** 8vo, 3*s.* 6*d.*

BRERETON, C. S. H.—**The Last Days of Olympus.** A Modern Myth. Crown 8vo, 3*s.* 6*d.*

BRIDGETT, Rev. T. E.—**Blunders and Forgeries.** Historical Essays. Crown 8vo, 6*s.*

BROWN, Horatio F.—**Life on the Lagoons.** With 2 Illustrations and Map. Crown 8vo, 6*s.*

Venetian Studies. Crown 8vo, 7*s.* 6*d.*

BROWN, Marie A.—**The Icelandic Discoverers of America**, or, Honour to whom Honour is due. With 8 Plates. Crown 8vo, 7*s.* 6*d.*

BROWNE, Hugh Junor.—**The Grand Reality.** Being Experiences in Spirit-Life of a Celebrated Dramatist, received through a Trance Medium. Edited by HUGH JUNOR BROWNE. Large post 8vo, 7*s.* 6*d.*

Browning Society's Papers.—Demy 8vo, 1881–84. Part I., 10*s.* Part II., 10*s.* Part III., 10*s.* Part IV., 10*s.* Part V., 10*s.* Part VII., 10*s.* Part VIII., 10*s.* Part IX., 10*s.* Part X., 10*s.*

BROWNING.—**Bibliography of Robert Browning** from 1833–81. 12*s.*

Poems of, Illustrations to. Parts I. and II. 4to, 10*s.* each.

BRUGMANN, Karl.—**Elements of a Comparative Grammar of the Indo-Germanic Languages.** Translated by JOSEPH WRIGHT. Vol. I. Introduction and Phonetics. 8vo, 18*s.*

BRYANT, Sophie, D.Sc.—**Celtic Ireland.** With 3 Maps. Crown 8vo, 5*s.*

BURKE, The Late Very Rev. T. N.—**His Life.** By W. J. FITZPATRICK. 2 vols. With Portrait. Demy 8vo, 30*s.*

Burma.—The British Burma Gazetteer. Compiled by Major H. R. SPEARMAN, under the direction of the Government of India. 2 vols. With 11 Photographs. 8vo, £2 10*s.*

BURTON, Lady.—**The Inner Life of Syria, Palestine, and the Holy Land.** Post 8vo, 6*s.*

BURY, Richard de.—**Philobiblon.** Edited by E. C. THOMAS. Crown 8vo, 10*s.* 6*d.*

CAMPBELL, Wm.—**An Account of Missionary Success in the Island of Formosa.** Published in London in 1650, and now reprinted with copious Appendices. 2 vols. With 6 Illustrations and Map of Formosa. Crown 8vo, 10*s.*

The Gospel of St. Matthew in Formosan (Sinkang Dialect). With Corresponding Versions in Dutch and English. Edited from Gravius's Edition of 1661. Fcap. 4to, 10*s.* 6*d.*

CATLIN, George.—**O-Kee-Pa.** A Religious Ceremony; and other Customs of the Mandans. With 13 Coloured Illustrations. Small 4to, 14*s.*

The Lifted and Subsided Rocks of America, with their Influence on the Oceanic, Atmospheric, and Land Currents, and the Distribution of Races. With 2 Maps. Crown 8vo, 6*s.* 6*d.*

Shut your Mouth and Save your Life. With 29 Illustrations. Eighth Edition. Crown 8vo, 2*s.* 6*d.*

CHAMBERS, John David.—**The Theological and Philosophical Works of Hermes Trismegistus, Christian Neoplatonist.** Translated from the Greek. Demy 8vo, 7*s.* 6*d.*

CHARNOCK, Richard Stephen.—**A Glossary of the Essex Dialect.** Fcap., 3*s.* 6*d.*

Nuces Etymologicæ. Crown 8vo, 10*s.*

Prœnomina; or, The Etymology of the Principal Christian Names of Great Britain and Ireland. Crown 8vo, 6*s.*

Chaucer Society.—Subscription, two guineas per annum. List of Publications on application.

CLAPPERTON, Jane Hume.—**Scientific Meliorism and the Evolution of Happiness.** Large crown 8vo, 8*s.* 6*d.*

CLARKE, Henry W.—**The History of Tithes, from Abraham to Queen Victoria.** Crown 8vo, 5*s.*

CLAUSEWITZ, General Carl von.—**On War.** Translated by Colonel J. J. GRAHAM. Fcap. 4to, 10*s.* 6*d.*

CLEMENT, C. E., and HUTTON, L.—**Artists of the Nineteenth Century and their Works.** Two Thousand and Fifty Biographical Sketches. Third, Revised Edition. Crown 8vo, 15*s.*

CLODD, Edward, F.R.A.S.—**The Childhood of the World:** a Simple Account of Man in Early Times. Eighth Edition. Crown 8vo, 3*s.*

A Special Edition for Schools. 1*s.*

The Childhood of Religions. Including a Simple Account of the Birth and Growth of Myths and Legends. Eighth Thousand. Crown 8vo, 5*s.*

A Special Edition for Schools. 1*s.* 6*d.*

DD, Edward, F.R.A.S.—continued.

Jesus of Nazareth. With a brief sketch of Jewish History to the Time of His Birth. Second Edition. Small crown 8vo, 6*s.*

A Special Edition for Schools. In 2 parts. Each 1*s.* 6*d.*

EBROOKE, Henry Thomas.—**Life and Miscellaneous Essays of.** The Biography by his Son, Sir T. E. COLEBROOKE, Bart., M.P. 3 vols. Demy 8vo, 42*s.*

LETTE, Charles Hastings.—**The Life, Times, and Writings of Thomas Cranmer, D.D., the First Reforming Archbishop of Canterbury.** Demy 8vo, 7*s.* 6*d.*

Pope Joan. An Historical Study. Translated from the Greek, with Preface. 12mo, 2*s.* 6*d.*

LINS, Mabel.—**Through the Gates of Gold.** A Fragment of Thought. Small 8vo, 4*s.* 6*d.*

'WAY, Moncure D.—**Travels in South Kensington.** Illustrated. 8vo, 12*s.*

K, Louisa S.—**Geometrical Psychology;** or, The Science of Representation. An Abstract of the Theories and Diagrams of B. W. Betts. 16 Plates, coloured and plain. Demy 8vo, 7*s.* 6*d.*

'TON, H. J. S.—**New India, or India in Transition.** Third Edition. Crown 8vo, 4*s.* 6*d.*; Cheap Edition, paper covers, 1*s.*

'TON, Louise.—**Palmistry and its Practical Uses.** 12 Plates. Crown 8vo, 2*s.* 6*d.*

, Rev. Sir George W., M.A., Bart.—**The Mythology of the Aryan Nations.** New Edition. Demy 8vo, 16*s.*

Tales of Ancient Greece. New Edition. Small crown 8vo, 6*s.*

A Manual of Mythology in the form of Question and Answer. New Edition. Fcap. 8vo, 3*s.*

An Introduction to the Science of Comparative Mythology and Folk-Lore. Second Edition. Crown 8vo, 7*s.* 6*d.*

, Rev. Sir G. W., M.A., Bart., and JONES, Eustace Hinton.—**Popular Romances of the Middle Ages.** Third Edition, in 1 vol. Crown 8vo, 6*s.*

R, Edward M.—**The Australian Race: Its Origin, Languages, Customs, Place of Landing in Australia, and the Routes by which it spread itself over that Continent.** In 4 vols. With Map and Illustrations. £2 2*s.*

T, R. N.—**The Shrines of Lourdes, Zaragossa, the Holy Stairs at Rome, the Holy House of Loretto and Nazareth, and St. Ann at Jerusalem.** With 4 Autotypes. Fcap. 8vo, 2*s.*

Davis, Thomas: The Memoirs of an Irish Patriot, 1840-46. By Sir CHARLES GAVAN DUFFY, K.C.M.G. Demy 8vo, 12*s.*

DAVITT, Michael.—**Speech before the Special Commission.** Crown 8vo, 5*s.*

DAWSON, Geo.—**Biographical Lectures.** Edited by GEORGE ST. CLAIR, F.G.S. Third Edition. Large crown 8vo, 7*s.* 6*d.*

Shakespeare, and other Lectures. Edited by GEORGE ST. CLAIR, F.G.S. Large crown 8vo, 7*s.* 6*d.*

DEAN, Teresa H.—**How to be Beautiful.** Nature Unmasked. A Book for Every Woman. Fcap. 8vo, 2*s.* 6*d.*

DEATH, J.—**The Beer of the Bible: one of the hitherto Unknown Leavens of Exodus.** With a Visit to an Arab Brewery, and Map of the Routes of the Exodus, etc. Crown 8vo, 6*s.*

DE JONCOURT, Madame Marie.—**Wholesome Cookery.** Fifth Edition. Crown 8vo, cloth, 1*s.* 6*d.*; paper covers, 1*s.*

DENMAN, Hon. G.—**The Story of the Kings of Rome.** In Verse. 16mo, parchment, 1*s.* 6*d.*

DONOVAN, J.—**Music and Action**; or, The Elective Affinity between Rhythm and Pitch. Crown 8vo, 3*s.* 6*d.*

DOWDEN, Edward, LL.D.—**Shakspere: a Critical Study** of his Mind and Art. Ninth Edition. Post 8vo, 12*s.*

Shakspere's Sonnets. With Introduction and Notes. Large post 8vo, 7*s.* 6*d.*

Studies in Literature, 1789–1877. Fourth Edition. Large post 8vo, 6*s.*

Transcripts and Studies. Large post 8vo, 12*s.*

DOWSETT, F. C.—**Striking Events in Irish History.** Crown 8vo, 2*s.* 6*d.*

Dreamland and Ghostland. An Original Collection of Tales and Warnings from the Borderland of Substance and Shadow. 3 vols. 6*s.* per vol., sold separately.

Drummond, Thomas, Under Secretary in Ireland, 1835–40. Life and Letters. By R. BARRY O'BRIEN. Demy 8vo, 14*s.*

DU PREL, Carl.—**The Philosophy of Mysticism.** Translated from the German by C. C. MASSEY. 2 vols. Demy 8vo, cloth, 25*s.*

Early English Text Society.—Subscription, one guinea per annum. *Extra Series.* Subscriptions—Small paper, one guinea per annum. List of Publications on application.

EDMUNDSON, George.—**Milton and Vondel.** A Curiosity of Literature. Crown 8vo, 6*s.*

WARDS, Edward.—**Memoirs of Libraries**, together with a Practical Handbook of Library Economy. Numerous Illustrations. 2 vols. Royal 8vo, £2 8*s*. Large paper Edition. Imperial 8vo, £4 4*s*.

Libraries and Founders of Libraries. 8vo, 18*s*. Large paper Edition. Imperial 8vo, £1 10*s*.

Free Town Libraries, their Formation, Management, and History in Britain, France, Germany, and America. Together with Brief Notices of Book Collectors, and of the respective Places of Deposit of their Surviving Collections. 8vo, 21*s*.

ghteenth Century Essays. Selected and Edited by AUSTIN DOBSON. Cheap Edition. Cloth, 1*s*. 6*d*.

lis, William (Founder of the Birkbeck Schools). Life, with Account of his Writings. By E. KELL BLYTH. Demy 8vo, 14*s*.

aerson's (Ralph Waldo) Life. By OLIVER WENDELL HOLMES. English Copyright Edition. With Portrait. Crown 8vo, 6*s*.

aerson (Ralph Waldo), Talks with. By CHARLES J. WOODBURY. Crown 8vo, 5*s*.

glish Dialect Society.—Subscription, 10*s*. 6*d*. per annum. List of Publications on application.

ELD, David Dudley.—**Outlines of an International Code.** Second Edition. Royal 8vo, £2 2*s*.

ve o'clock Tea. Containing Receipts for Cakes, Savoury Sandwiches, etc. Eighth Thousand. Fcap. 8vo, cloth, 1*s*. 6*d*.; paper covers, 1*s*.

rbes, Bishop. A Memoir. By the Rev. DONALD J. MACKAY. With Portrait and Map. Crown 8vo, 7*s*. 6*d*.

THERINGHAM, James.—**Studies in the Poetry of Robert Browning.** Second Edition. Crown 8vo, 6*s*.

X, Charles.—**The Pilgrims.** An Allegory of the Soul's Progress from the Earthly to the Heavenly State. Crown 8vo, 5*s*.

X, J. A.—**A Key to the Irish Question.** Crown 8vo, 7*s*. 6*d*.

ANKLYN, Henry Bowles.—**The Great Battles of 1870, and Blockade of Metz.** With Large Map, Sketch Map, and Frontispiece. 8vo, 15*s*.

EEBOROUGH, E., and RANKEN, C. E.—**Chess Openings,** Ancient and Modern. Revised and Corrected up to the Present Time from the best Authorities. Large post 8vo, 7*s*. 6*d*.; interleaved, 9*s*.

EEMAN, E. A.—**Lectures to American Audiences.** I. The English People in its Three Homes. II. Practical Bearings of General European History. Post 8vo, 8*s*. 6*d*

FRITH, I.—**Life of Giordano Bruno, the Nolan.** Revised by Prof. Moriz Carriere. With Portrait. Post 8vo, 14*s.*

Froebel's Ethical Teaching. Two Essays by M. J. Lyschinska and Therese G. Montefiore. Fcap., 2*s.* 6*d.*

From World to Cloister; or, My Novitiate. By Bernard. Crown 8vo, 5*s.*

Garfield, The Life and Public Service of James A., Twentieth President of the United States. A Biographical Sketch. By Captain F. H. Mason. With a Preface by Bret Harte. With Portrait. Crown 8vo, 2*s.* 6*d.*

GASTER, M.—**Greeko-Slavonic Literature and its Relation to the Folk-Lore of Europe during the Middle Ages.** Large post 8vo, 7*s.* 6*d.*

GEORGE, Henry.—**Progress and Poverty.** An Inquiry into the Causes of Industrial Depressions, and of Increase of Want with Increase of Wealth. The Remedy. Fifth Library Edition. Post 8vo, 7*s.* 6*d.* Cabinet Edition. Crown 8vo, 2*s.* 6*d.* Also a Cheap Edition. Limp cloth, 1*s.* 6*d.*; paper covers, 1*s.*

Protection, or Free Trade. An Examination of the Tariff Question, with especial regard to the Interests of Labour. Second Edition. Crown 8vo, 5*s.* Cheap Edition. Limp cloth, 1*s.* 6*d.*; paper covers, 1*s.*

Social Problems. Fourth Thousand. Crown 8vo, 5*s.* Cheap Edition. Limp cloth, 1*s.* 6*d.*; paper covers, 1*s.*

GIBB, E. J. W.—**The History of the Forty Vezirs**; or, The Story of the Forty Morns and Eves. Translated from the Turkish. Crown 8vo, 10*s.* 6*d.*

GILBERT, Mrs.—**Autobiography, and other Memorials.** Edited by Josiah Gilbert. Fifth Edition. Crown 8vo, 7*s.* 6*d.*

Glossary of Terms and Phrases. Edited by the Rev. H. Percy Smith and others. Second and Cheaper Edition. Medium 8vo, 3*s.* 6*d.*

Goethe's Faust. Translated from the German by John Anster, LL.D. With an Introduction by Burdett Mason. Illustrated by Frank M. Gregory. Folio, £3 3*s.*

GORDON, Major-General C. G.—**His Journals at Kartoum.** Printed from the original MS. With Introduction and Notes by A. Egmont Hake. Portrait, 2 Maps, and 30 Illustrations. Two vols., demy 8vo, 21*s.* Also a Cheap Edition in 1 vol., 6*s.*

Gordon's (General) Last Journal. A Facsimile of the last Journal received in England from General Gordon. Reproduced by Photo-lithography. Imperial 4to, £3 3*s.*

GORDON, Major-General C. G.—continued.

Events in his Life. From the Day of his Birth to the Day of his Death. By Sir H. W. GORDON. With Maps and Illustrations. Second Edition. Demy 8vo, 7*s.* 6*d.*

GOSSE, Edmund.—**Seventeenth Century Studies.** A Contribution to the History of English Poetry. Demy 8vo, 10*s.* 6*d.*

GOSSIP, G. H. D.—**The Chess-Player's Text-Book.** An Elementary Treatise on the Game of Chess. Illustrated by numerous Diagrams for Beginners and Advanced Students. Medium 16mo, 2*s.*

GOULD, Rev. S. Baring, M.A.—**Germany, Present and Past.** New and Cheaper Edition. Large crown 8vo, 7*s.* 6*d.*

GOWER, Lord Ronald.—**My Reminiscences.** MINIATURE EDITION, printed on hand-made paper, limp parchment antique, 10*s.* 6*d.*

Bric-à-Brac. Being some Photoprints illustrating art objects at Gower Lodge, Windsor. With descriptions. Super royal 8vo, 15*s.*; extra binding, 21*s.*

Last Days of Mary Antoinette. An Historical Sketch. With Portrait and Facsimiles. Fcap. 4to, 10*s.* 6*d.*

Notes of a Tour from Brindisi to Yokohama, 1883–1884. Fcap. 8vo, 2*s.* 6*d.*

Rupert of the Rhine: A Biographical Sketch of the Life of Prince Rupert. With 3 Portraits. Crown 8vo, buckram, 6*s.*

GRAHAM, William, M.A.—**The Creed of Science,** Religious, Moral, and Social. Second Edition, Revised. Crown 8vo, 6*s.*

The Social Problem, in its Economic, Moral, and Political Aspects. Demy 8vo, 14*s.*

GUBERNATIS, Angelo de.—**Zoological Mythology;** or, The Legends of Animals. 2 vols. 8vo, £1 8*s.*

GURNEY, Rev. Alfred.—**Wagner's Parsifal.** A Study. Fcap. 8vo, 1*s.* 6*d.*

HADDON, Caroline.—**The Larger Life: Studies in Hinton's Ethics.** Crown 8vo, 5*s.*

HAGGARD, H. Rider.—**Cetywayo and his White Neighbours;** or, Remarks on Recent Events in Zululand, Natal, and the Transvaal. Third Edition. Crown 8vo, 6*s.*

HALDEMAN, S. S.—**Pennsylvania Dutch:** A Dialect of South Germany with an Infusion of English. 8vo, 3*s.* 6*d.*

HALL, F. T.—**The Pedigree of the Devil.** With 7 Autotype Illustrations from Designs by the Author. Demy 8vo, 7*s.* 6*d.*

HALLOCK, Charles.—**The Sportsman's Gazetteer and General Guide.** The Game Animals, Birds, and Fishes of North America. Maps and Portrait. Crown 8vo, 15*s.*

Hamilton, Memoirs of Arthur, B.A., of Trinity College, Cambridge. Crown 8vo, 6*s.*

Handbook of Home Rule, being Articles on the Irish Question by Various Writers. Edited by JAMES BRYCE, M.P. Second Edition. Crown 8vo, 1*s.* sewed, or 1*s.* 6*d.* cloth.

HARRIS, Emily Marion.—**The Narrative of the Holy Bible.** Crown 8vo, 5*s.*

HARTMANN, Franz.—**Magic, White and Black;** or, The Science of Finite and Infinite Life. Crown 8vo, 7*s.* 6*d.*

The Life of Paracelsus, and the Substance of his Teachings. Post 8vo, 10*s.* 6*d.*

Life and Doctrines of Jacob Behmen. Post 8vo, 10*s.* 6*d.*

HAWTHORNE, Nathaniel.—**Works.** Complete in Twelve Volumes. Large post 8vo, 7*s.* 6*d.* each volume.

HECKER, J. F. C.—**The Epidemics of the Middle Ages.** Translated by G. B. BABINGTON, M.D., F.R.S. Third Edition. 8vo, 9*s.* 6*d.*

HENDRIK, Hans.—**Memoirs of Hans Hendrik, the Arctic Traveller;** serving under Kane, Hayes, Hall, and Nares, 1853-76. Translated from the Eskimo Language by Dr. HENRY RINK. Crown 8vo, 3*s.* 6*d.*

HENDRIKS, Dom Lawrence.—**The London Charterhouse:** its Monks and its Martyrs. Illustrated. Demy 8vo, 14*s.*

HERZEN, Alexander.—**Du Developpement des Idées Revolutionnaires en Russie.** 12mo, 2*s.* 6*d.*

A separate list of A. Herzen's works in Russian may be had on application.

HILL, Alfred.—**The History of the Reform Movement** in the Dental Profession in Great Britain during the last twenty years. Crown 8vo, 10*s.* 6*d.*

HILLEBRAND, Karl.—**France and the French in the Second Half of the Nineteenth Century.** Translated from the Third German Edition. Post 8vo, 10*s.* 6*d.*

HINTON, J.—**Life and Letters.** With an Introduction by Sir W. W. GULL, Bart., and Portrait engraved on Steel by C. H. Jeens. Sixth Edition. Crown 8vo, 8*s.* 6*d.*

Philosophy and Religion. Selections from the Manuscripts of the late James Hinton. Edited by CAROLINE HADDON. Second Edition. Crown 8vo, 5*s.*

The Law Breaker, and The Coming of the Law. Edited by MARGARET HINTON. Crown 8vo, 6*s.*

The Mystery of Pain. New Edition. Fcap. 8vo, 1*s.*

HODGSON, J. E.—**Academy Lectures.** Crown 8vo, 7*s.* 6*d.*

Holbein Society.—Subscription, one guinea per annum. List of Publications on application.

HOLMES-FORBES, Avary W.—**The Science of Beauty.** An Analytical Inquiry into the Laws of Æsthetics. Second Edition. Post 8vo, 3*s*. 6*d*.

HOLYOAKE, G. J.—**The History of Co-operation in England:** Its Literature and its Advocates. 2 vols. Crown 8vo, 14*s*.

Self-Help by the People. Thirty-three Years of Co-operation in Rochdale. Ninth Edition. Crown 8vo, 2*s*. 6*d*.

HOME, Mme. Dunglas.—**D. D. Home: His Life and Mission.** With Portrait. Demy 8vo, 12*s*. 6*d*.

Gift of D. D. Home. Demy 8vo, 10*s*.

Homer's Iliad. Greek Text with Translation. By J. G. CORDERY, C.S.I. Two vols. Demy 8vo, 14*s*. Cheap Edition, Translation only. One vol. Crown 8vo, 5*s*.

HOOLE, Henry.—**The Science and Art of Training.** A Handbook for Athletes. Demy 8vo, 3*s*. 6*d*.

HOOPER, Mary.—**Little Dinners: How to Serve them with Elegance and Economy.** Twenty-first Edition. Crown 8vo, 2*s*. 6*d*.

Cookery for Invalids, Persons of Delicate Digestion, and Children. Fifth Edition. Crown 8vo, 2*s*. 6*d*.

Every-day Meals. Being Economical and Wholesome Recipes for Breakfast, Luncheon, and Supper. Seventh Edition. Crown 8vo, 2*s*. 6*d*.

HOPKINS, Ellice.—**Work amongst Working Men.** Sixth Edition. Crown 8vo, 3*s*. 6*d*.

HORNADAY, W. T.—**Two Years in a Jungle.** With Illustrations. Demy 8vo, 21*s*.

HOWELLS, W. D.—**A Little Girl among the Old Masters.** With Introduction and Comment. 54 Plates. Oblong crown 8vo, 10*s*.

HUMBOLDT, Baron Wilhelm Von.—**The Sphere and Duties of Government.** Translated from the German by JOSEPH COULTHARD, Jun. Post 8vo, 5*s*.

HYNDMAN, H. M.—**The Historical Basis of Socialism in England.** Large crown 8vo, 8*s*. 6*d*.

IM THURN, Everard F.—**Among the Indians of Guiana.** Being Sketches, chiefly anthropologic, from the Interior of British Guiana. With 53 Illustrations and a Map. Demy 8vo, 18*s*.

INGLEBY, the late Clement M.—**Essays.** Edited by his Son. Crown 8vo, 7*s*. 6*d*.

Irresponsibility and its Recognition. By a Graduate of Oxford. Crown 8vo, 3*s.* 6*d.*

JAGIELSKI, V.—**Modern Massage Treatment in Combination with the Electric Bath.** 8vo, 1*s.* 6*d.*

JAPP, Alexander H.—**Days with Industrials.** Adventures and Experiences among Curious Industries. With Illustrations. Crown 8vo, 6*s.*

JENKINS, E., and RAYMOND, J.—**The Architect's Legal Handbook.** Fourth Edition, Revised. Crown 8vo, 6*s.*

JENKINS, E.—**A Modern Paladin.** Contemporary Manners. Crown 8vo, 5*s.*

JENKINS, Jabez.—**Vest-Pocket Lexicon.** An English Dictionary of all except familiar Words, including the principal Scientific and Technical Terms, and Foreign Moneys, Weights, and Measures. 64mo, 1*s.*

JENKINS, Rev. Canon R. C.—**Heraldry: English and Foreign.** With a Dictionary of Heraldic Terms and 156 Illustrations. Small crown 8vo, 3*s.* 6*d.*

Jesus the Carpenter of Nazareth. By a Layman. Crown 8vo, 7*s.* 6*d.*

JOHNSON, C. P.—**Hints to Collectors of Original Editions of the Works of Charles Dickens.** Crown 8vo, vellum, 6*s.*

Hints to Collectors of Original Editions of the Works of William Makepeace Thackeray. Crown 8vo, vellum, 6*s.*

JOHNSTON, H. H., F.Z.S.—**The Kilima-njaro Expedition.** A Record of Scientific Exploration in Eastern Equatorial Africa, and a General Description of the Natural History, Languages, and Commerce of the Kilima-njaro District. With 6 Maps, and over 80 Illustrations by the Author. Demy 8vo, 21*s.*

The History of a Slave. With 47 Illustrations. Square 8vo, 6*s.*

Juvenalis Satiræ. With a Literal English Prose Translation and Notes. By J. D. Lewis. Second Edition. 2 vols. 8vo, 12*s.*

KARDEC, Allen.—**The Spirit's Book.** The Principles of Spiritist Doctrine on the Immortality of the Soul, etc. Transmitted through various mediums. Translated by Anna Blackwell. Crown 8vo, 7*s.* 6*d.*

The Medium's Book; or, Guide for Mediums and for Evocations. Translated by Anna Blackwell. Crown 8vo, 7*s.* 6*d.*

Heaven and Hell; or, The Divine Justice Vindicated in the Plurality of Existences. Translated by Anna Blackwell. Crown 8vo, 7*s.* 6*d.*

KAUFMANN, Rev. M., M.A.—**Socialism**: its Nature, its Dangers, and its Remedies considered. Crown 8vo, 7*s.* 6*d.*

Utopias; or, Schemes of Social Improvement, from Sir Thomas More to Karl Marx. Crown 8vo, 5*s.*

Christian Socialism. Crown 8vo, 4*s.* 6*d.*

KERRISON, Lady Caroline.—**A Commonplace Book of the Fifteenth Century.** Containing a Religious Play and Poetry, Legal Forms, and Local Accounts. From the Original MS. at Brome Hall, Suffolk. Edited by LUCY TOULMIN SMITH. With 2 Facsimiles. Demy 8vo, 7*s.* 6*d.*

KINGSFORD, Anna, M.D.—**The Perfect Way in Diet.** A Treatise advocating a Return to the Natural and Ancient Food of our Race. Third Edition. Small crown 8vo, 2*s.*

The Spiritual Hermeneutics of Astrology and Holy Writ. Illustrated. 4to, parchment, 10*s.* 6*d.*

KINGSFORD, Anna, and MAITLAND, Edward.—**The Virgin of the World of Hermes Mercurius Trismegistus.** Rendered into English. 4to, parchment, 10*s.* 6*d.*

The Perfect Way; or, The Finding of Christ. Third Edition, Revised. Square 16mo, 7*s.* 6*d.*

KINGSFORD, William.—**History of Canada.** 3 vols. 8vo, £2 5*s.*

KITTON, Fred. G.—**John Leech, Artist and Humourist.** A Biographical Sketch. Demy 18mo, 1*s.*

KRAUS, J.—**Carlsbad and its Natural Healing Agents.** With Notes, Introductory, by the Rev. JOHN T. WALLERS. Third Edition. Crown 8vo, 6*s.* 6*d.*

LAMB, Charles.—**Beauty and the Beast**; or, A Rough Outside with a Gentle Heart. A Poem. Fcap. 8vo, vellum, 10*s.* 6*d.*

LANG, Andrew.—**Lost Leaders.** Crown 8vo, 5*s.*

Lathe (The) and its Uses; or, Instruction in the Art of Turning Wood and Metal. Sixth Edition. Illustrated. 8vo, 10*s.* 6*d.*

LEE, Frederick Geo.—**A Manual of Politics.** In three Chapters. With Footnotes and Appendices. Small crown 8vo, 2*s.* 6*d.*

LEFEVRE, Right Hon. G. Shaw.—**Peel and O'Connell.** Demy 8vo, 10*s.* 6*d.*

Incidents of Coercion. A Journal of Visits to Ireland. Third Edition. Crown 8vo, limp cloth, 1*s.* 6*d.*; paper covers, 1*s.*

Irish Members and English Gaolers. Crown 8vo, limp cloth, 1*s.* 6*d.*; paper covers, 1*s.*

Combination and Coercion in Ireland. A Sequel to "Incidents of Coercion." Crown 8vo, cloth, 1*s.* 6*d.*; paper covers, 1*s.*

LELAND, Charles G.—**The Breitmann Ballads.** The only authorized Edition. Complete in 1 vol., including Nineteen Ballads, illustrating his Travels in Europe (never before printed). Crown 8vo, 6*s.*

Gaudeamus. Humorous Poems translated from the German of JOSEPH VICTOR SCHEFFEL and others. 16mo, 3*s.* 6*d.*

The English Gipsies and their Language. Second Edition. Crown 8vo, 7*s.* 6*d.*

Fu-Sang; or, The Discovery of America by Chinese Buddhist Priests in the Fifth Century. Crown 8vo, 7*s.* 6*d.*

Pidgin-English Sing-Song; or, Songs and Stories in the China-English Dialect. With a Vocabulary. Second Edition. Crown 8vo, 5*s.*

The Gypsies. Crown 8vo, 10*s.* 6*d.*

Light on the Path. For the Personal Use of those who are Ignorant of the Eastern Wisdom. Written down by M. C. Fcap. 8vo, 1*s.* 6*d.*

LOCHER, Carl.—**An Explanation of Organ Stops,** with Hints for Effective Combinations. Demy 8vo, 5*s.*

LONGFELLOW, H. Wadsworth.—**Life.** By his Brother, SAMUEL LONGFELLOW. With Portraits and Illustrations. 3 vols. Demy 8vo, 42*s.*

LONSDALE, Margaret.—**Sister Dora**: a Biography. With Portrait. Thirtieth Edition. Small crown 8vo, 2*s.* 6*d.*

George Eliot: Thoughts upon her Life, her Books, and **Herself.** Second Edition. Small crown 8vo, 1*s.* 6*d.*

Lotos Series (The). Pot 8vo, bound in two styles: (1) cloth, gilt back and edges; (2) half-parchment, cloth sides, gilt top, uncut, 3*s.* 6*d.* each.

The Original Travels and Surprising Adventures of **Baron Munchausen.** Illustrated by ALFRED CROWQUILL.

The Breitmann Ballads. By CHARLES G. LELAND. Author's Copyright Edition, with a New Preface and Additional Poems.

Essays on Men and Books Selected from the Earlier Writings of Lord Macaulay. Vol. I. Introductory—Lord Clive—Milton—Earl Chatham—Lord Byron. With Critical Introduction and Notes by ALEXANDER H. JAPP, LL.D. With Portraits.

The Light of Asia; or, The Great Renunciation. Being the Life and Teaching of Gautama, Prince of India and Founder of Buddhism. Told in Verse by an Indian Buddhist. By Sir EDWIN ARNOLD, K.C.I.E., C.S.I. With Illustrations and a Portrait of the Author.

os Series (The)—*continued.*

The Marvellous and Rare Conceits of Master Tyll Owlglass. Newly Collected, Chronicled, and set forth in an English Tongue. By KENNETH H. R. MACKENZIE. Adorned with many most Diverting and Cunning Devices by ALFRED CROWQUILL.

A Lover's Litanies, and other Poems. By ERIC MACKAY. With Portrait of the Author.

The Large Paper Edition of these Volumes will be limited to 101 numbered copies for sale in England, price 12*s.* 6*d.* each, net.

vder, Charles: A Biography. By the Author of "St. Teresa." Twelfth Edition. With Portrait. Crown 8vo, 3*s.* 6*d.*

VELL, James Russell.—**The Biglow Papers.** Edited by THOMAS HUGHES, Q.C. First and Second Series in 1 vol. Fcap., 2*s.* 6*d.*

VSLEY, Major B.—**A Glossary of Berkshire Words and Phrases.** Crown 8vo, half-calf, gilt edges, interleaved, 12*s.* 6*d.*

CKES, Eva C. E.—**Lectures on General Nursing,** delivered to the Probationers of the London Hospital Training School for Nurses. Third Edition. Crown 8vo, 2*s.* 6*d.*

DEWIG, Hermann E.—**The Literature of American Aboriginal Languages.** Edited by NICOLAS TRÜBNER. 8vo, 10*s.* 6*d.*

KIN, J.—**Amongst Machines.** A Description of Various Mechanical Appliances used in the Manufacture of Wood, Metal, etc. A Book for Boys. Second Edition. 64 Engravings. Crown 8vo, 3*s.* 6*d.*

The Young Mechanic. Containing Directions for the Use of all Kinds of Tools, and for the Construction of Steam-Engines, etc. A Book for Boys. Second Edition. With 70 Engravings. Crown 8vo, 3*s.* 6*d.*

The Boy Engineers: What they Did, and How they Did it. A Book for Boys. 30 Engravings. Imperial 16mo, 3*s.* 6*d.*

ILEY, E.—**The Art of Judging the Character of Individuals from their Handwriting and Style.** With 35 Plates. Square 16mo, 5*s.*

TON, Edward Bulwer, Lord.—**Life, Letters and Literary Remains.** By his Son, the EARL OF LYTTON. With Portraits, Illustrations and Facsimiles. Demy 8vo. Vols. I. and II., 32*s.*

CDONALD, W. A.—**Humanitism:** The Scientific Solution of the Social Problem. Large post 8vo, 7*s.* 6*d.*

MACHIAVELLI, Niccolò.

Discourses on the First Decade of Titus Livius. Translated from the Italian by NINIAN HILL THOMSON, M.A. Large crown 8vo, 12*s*.

The Prince. Translated from the Italian by N. H. T. Small crown 8vo, printed on hand-made paper, bevelled boards, 6*s*.

MAIDEN, J. H.—**The Useful Native Plants of Australia** (including Tasmania). Demy 8vo, 12*s*. 6*d*.

Maintenon, Madame de. By EMILY BOWLES. With Portrait. Large crown 8vo, 7*s*. 6*d*.

MARCHANT, W. T.—**In Praise of Ale.** Songs, Ballads, Epigrams, and Anecdotes. Crown 8vo, 10*s*. 6*d*.

MARKHAM, Capt. Albert Hastings, R.N.—**The Great Frozen Sea:** A Personal Narrative of the Voyage of the *Alert* during the Arctic Expedition of 1875-6. With 6 full-page Illustrations, 2 Maps, and 27 Woodcuts. Sixth and Cheaper Edition. Crown 8vo, 6*s*.

Marriage and Divorce. Including Religious, Practical, and Political Aspects of the Question. By AP RICHARD. Crown 8vo, 5*s*.

MARTIN, G. A.—**The Family Horse:** Its Stabling, Care, and Feeding. Crown 8vo, 3*s*. 6*d*.

MATHERS, S. L. M.—**The Key of Solomon the King.** Translated from Ancient MSS. in the British Museum. With Plates. Crown 4to, 25*s*.

The Kabbalah Unveiled. Containing the Three Books of the Zohar. Translated into English. With Plates. Post 8vo, 10*s*. 6*d*.

The Tarot: its Occult Signification, Use in Fortune-Telling, and Method of Play. 32mo, 1*s*. 6*d*.; with pack of 78 Tarot Cards, 5*s*.

MAUDSLEY, H., M.D.—**Body and Will.** Being an Essay concerning Will, in its Metaphysical, Physiological, and Pathological Aspects. 8vo, 12*s*.

Natural Causes and Supernatural Seemings. Second Edition. Crown 8vo, 6*s*.

Mechanic, The Young. A Book for Boys. Containing Directions for the Use of all Kinds of Tools, and for the Construction of Steam-Engines and Mechanical Models. By the Rev. J. LUKIN. Sixth Edition. With 70 Engravings. Crown 8vo, 3*s*. 6*d*.

Mechanic's Workshop, Amateur. Plain and Concise Directions for the Manipulation of Wood and Metals. By the Author of "The Lathe and its Uses." Sixth Edition. Illustrated. Demy 8vo, 6*s*.

endelssohn's Letters to Ignaz and Charlotte Moscheles. Translated by FELIX MOSCHELLES. Numerous Illustrations and Facsimiles. 8vo, 12*s.*

ETCALFE, Frederick.—**The Englishman and the Scandinavian.** Post 8vo, 18*s.*

NTON, Rev. Francis.—**Capital and Wages.** 8vo, 15*s.*

The Welfare of the Millions. Crown 8vo, limp cloth, 1*s.* 6*d.*; paper covers, 1*s.*

itchel, John, Life. By WILLIAM DILLON. 2 vols. With Portrait. 8vo, 21*s.*

TCHELL, Lucy M.—**A History of Ancient Sculpture.** With numerous Illustrations, including 6 Plates in Phototype. Super-royal 8vo, 42*s.*

ohl, Julius and Mary, Letters and Recollections of. By M. C. M. SIMPSON. With Portraits and 2 Illustrations. Demy 8vo, 15*s.*

ODIE, D. C. F.—**The History of the Battles and Adventures of the British, the Boers, the Zulus, etc., in Southern Africa,** from the Time of Pharaoh Necho to 1880. With Illustrations and Coloured Maps. 2 vols. Crown 8vo, 36*s.*

ORFIT, Campbell.—**A Practical Treatise on the Manufacture of Soaps.** With Illustrations. Demy 8vo, £2 12*s.* 6*d.*

A Practical Treatise on Pure Fertilizers, and the Chemical Conversion of Rock Guanos, etc., into various valuable Products, With 28 Plates. 8vo, £4 4*s.*

OORE, Aubrey L.—**Science and the Faith:** Essays on Apologetic Subjects. Crown 8vo, 6*s.*

ORISON, J. Cotter.—**The Service of Man:** an Essay towards the Religion of the Future. Crown 8vo, 5*s.*

ORRIS, Charles.—**Aryan Sun-Myths the Origin of Religions.** With an Introduction by CHARLES MORRIS. Crown 8vo, 6*s.*

ORRIS, Gouverneur, U.S. Minister to France.—**Diary and Letters.** 2 vols. Demy 8vo, 30*s.*

OSENTHAL, J. de, and HARTING, James E.—**Ostriches and Ostrich Farming.** Second Edition. With 8 full-page Illustrations and 20 Woodcuts. Royal 8vo, 10*s.* 6*d.*

otley, John Lothrop. A Memoir. By OLIVER WENDELL HOLMES. Crown 8vo, 6*s.*

ULHALL, M. G. and E. T.—**Handbook of the River Plate,** comprising the Argentine Republic, Uruguay, and Paraguay. With Six Maps. Fifth Edition. Crown 8vo, 7*s.* 6*d.*

unro, Major-Gen. Sir Thomas. A Memoir. By Sir A. J. ARBUTHNOT. Crown 8vo, 3*s.* 6*d.*

Natural History. "Riverside" Edition. Edited by J. S. KINGSLEY. 6 vols. 2200 Illustrations. 4to, £6 6*s*.

NEVILL, J. H. N.—**The Biology of Daily Life.** Post 8vo, 3*s*. 6*d*.

NEWMAN, Cardinal.—**Characteristics from the Writings of.** Being Selections from his various Works. Arranged with the Author's personal Approval. Eighth Edition. With Portrait. Crown 8vo, 6*s*.

⁂ A Portrait of Cardinal Newman, mounted for framing, can be had, 2*s*. 6*d*.

NEWMAN, Francis William.—**Essays on Diet.** Small crown 8vo, cloth limp, 2*s*.

Miscellanies. Vol. II., III., and IV. Essays, Tracts, and Addresses, Moral and Religious. Demy 8vo. Vols. II. and III., 12*s*. Vol. IV., 10*s*. 6*d*.

Reminiscences of Two Exiles and Two Wars. Crown 8vo, 3*s*. 6*d*.

Phases of Faith; or, Passages from the History of my Creed. Crown 8vo, 3*s*. 6*d*.

The Soul: Her Sorrows and her Aspirations. Tenth Edition. Post 8vo, 3*s*. 6*d*.

Hebrew Theism. Royal 8vo, 4*s*. 6*d*.

Anglo-Saxon Abolition of Negro Slavery. Demy 8vo, 5*s*.

New South Wales, Journal and Proceedings of the Royal Society of. Published annually. Price 10*s*. 6*d*.

New South Wales, Publications of the Government of. List on application.

New Zealand Institute Publications:—

I. **Transactions and Proceedings** of the New Zealand Institute. Vols. I. to XX., 1868 to 1887. Demy 8vo, stitched, £1 1*s*. each.

II. **An Index to the Transactions and Proceedings** of the New Zealand Institute. Edited by JAMES HECTOR, M.D., F.R.S. Vols. I. to VIII. Demy 8vo, 2*s*. 6*d*.

New Zealand: Geological Survey. List of Publications on application.

OATES, Frank, F.R.G.S.—**Matabele Land and the Victoria Falls.** A Naturalist's Wanderings in the Interior of South Africa. Edited by C. G. OATES, B.A. With numerous Illustrations and 4 Maps. Demy 8vo, 21*s*.

O'BRIEN, R. Barry.—**Irish Wrongs and English Remedies,** with other Essays. Crown 8vo, 5*s*.

O'BRIEN, R. Barry.—continued.

The Home Ruler's Manual. Crown 8vo, cloth, 1*s.* 6*d.*; paper covers, 1*s.*

OLCOTT, Henry S.—**Theosophy, Religion, and Occult Science.** With Glossary of Eastern Words. Crown 8vo, 7*s.* 6*d.*

Posthumous Humanity. A Study of Phantoms. By ADOLPHE D'ASSIER. Translated and Annotated by HENRY S. OLCOTT. Crown 8vo, 7*s.* 6*d.*

Our Public Schools—Eton, Harrow, Winchester, Rugby, Westminster, Marlborough, The Charterhouse. Crown 8vo, 6*s.*

OWEN, Robert Dale.—**Footfalls on the Boundary of Another World.** With Narrative Illustrations. Post 8vo, 7*s.* 6*d.*

The Debatable Land between this World and the Next. With Illustrative Narrations. Second Edition. Crown 8vo, 7*s.* 6*d.*

Threading my Way. Twenty-Seven Years of Autobiography. Crown 8vo, 7*s.* 6*d.*

OXLEY, William.—**Modern Messiahs and Wonder-Workers.** A History of the Various Messianic Claimants to Special Divine Prerogatives. Post 8vo, 5*s.*

Parchment Library. Choicely Printed on hand-made paper, limp parchment antique or cloth, 6*s.*; vellum, 7*s.* 6*d.* each volume.

Selected Poems of Matthew Prior. With an Introduction and Notes by AUSTIN DOBSON.

Sartor Resartus. By THOMAS CARLYLE.

The Poetical Works of John Milton. 2 vols.

Chaucer's Canterbury Tales. Edited by A. W. POLLARD, 2 vols.

Letters and Journals of Jonathan Swift. Selected and edited, with a Commentary and Notes, by STANLEY LANE-POOLE.

De Quincey's Confessions of an English Opium Eater. Reprinted from the First Edition. Edited by RICHARD GARNETT.

The Gospel according to **Matthew, Mark,** and **Luke.**

Selections from the Prose Writings of Jonathan Swift. With a Preface and Notes by STANLEY LANE-POOLE and Portrait.

English Sacred Lyrics.

Sir Joshua Reynolds's Discourses. Edited by EDMUND GOSSE.

Parchment Library—*continued.*

Selections from Milton's Prose Writings. Edited by ERNEST MYERS.

The Book of Psalms. Translated by the Rev. Canon T. K. CHEYNE, M.A., D.D.

The Vicar of Wakefield. With Preface and Notes by AUSTIN DOBSON.

English Comic Dramatists. Edited by OSWALD CRAWFURD.

English Lyrics.

The Sonnets of John Milton. Edited by MARK PATTISON. With Portrait after Vertue.

French Lyrics. Selected and Annotated by GEORGE SAINTSBURY. With a Miniature Frontispiece designed and etched by H. G. Glindoni.

Fables by Mr. John Gay. With Memoir by AUSTIN DOBSON, and an Etched Portrait from an unfinished Oil Sketch by Sir Godfrey Kneller.

Select Letters of Percy Bysshe Shelley. Edited, with an Introduction, by RICHARD GARNETT.

The Christian Year. Thoughts in Verse for the Sundays and Holy Days throughout the Year. With Miniature Portrait of the Rev. J. Keble, after a Drawing by G. Richmond, R.A.

Shakspere's Works. Complete in Twelve Volumes.

Eighteenth Century Essays. Selected and Edited by AUSTIN DOBSON. With a Miniature Frontispiece by R. Caldecott.

Q. Horati Flacci Opera. Edited by F. A. CORNISH, Assistant Master at Eton. With a Frontispiece after a design by L. Alma Tadema, etched by Leopold Lowenstam.

Edgar Allan Poe's Poems. With an Essay on his Poetry by ANDREW LANG, and a Frontispiece by Linley Sambourne.

Shakspere's Sonnets. Edited by EDWARD DOWDEN. With a Frontispiece etched by Leopold Lowenstam, after the Death Mask.

English Odes. Selected by EDMUND GOSSE. With Frontispiece on India paper by Hamo Thornycroft, A.R.A.

Of the Imitation of Christ. By THOMAS À KEMPIS. A revised Translation. With Frontispiece on India paper, from a Design by W. B. Richmond.

Poems: Selected from PERCY BYSSHE SHELLEY. Dedicated to Lady Shelley. With a Preface by RICHARD GARNETT and a Miniature Frontispiece.

PARSLOE, Joseph.—**Our Railways.** Sketches, Historical and Descriptive. With Practical Information as to Fares and Rates, etc., and a Chapter on Railway Reform. Crown 8vo, 6*s.*

PATON, A. A.—**A History of the Egyptian Revolution,** from the Period of the Mamelukes to the Death of Mohammed Ali. Second Edition. 2 vols. Demy 8vo, 7*s.* 6*d.*

PAULI, Reinhold.—**Simon de Montfort, Earl of Leicester,** the Creator of the House of Commons. Crown 8vo, 6*s.*

Paul of Tarsus. By the Author of "Rabbi Jeshua." Crown 8vo, 4*s.* 6*d.*

PEMBERTON, T. Edgar.—**Charles Dickens and the Stage.** A Record of his Connection with the Drama. Crown 8vo, 6*s.*

PEZZI, Domenico.—**Aryan Philology,** according to the most recent researches (Glottologia Aria Recentissima). Translated by E. S. ROBERTS. Crown 8vo, 6*s.*

PFEIFFER, Emily.—**Women and Work.** An Essay on the Relation to Health and Physical Development of the Higher Education of Girls. Crown 8vo, 6*s.*

Phantasms of the Living. By EDMUND GURNEY, FREDERIC W. H. MYERS, M.A., and FRANK PODMORE, M.A. 2 vols. Demy 8vo, 21*s.*

Philological Society, Transactions of. Published irregularly. List of Publications on application.

PICCIOTTO, James.—**Sketches of Anglo-Jewish History.** Demy 8vo, 12*s.*

Pierce Gambit: Chess Papers and Problems. By JAMES PIERCE, M.A., and W. TIMBRELL PIERCE. Crown 8vo, 6*s.* 6*d.*

PIESSE, Charles H.—**Chemistry in the Brewing-Room.** Being the substance of a Course of Lessons to Practical Brewers. Fcap., 5*s.*

PLINY.—**The Letters of Pliny the Younger.** Translated by J. D. LEWIS. Post 8vo, 5*s.*

PLUMPTRE, Charles John.—**King's College Lectures on Elocution.** Fourth Edition. Post 8vo, 15*s.*

POOLE, W. F.—**An Index to Periodical Literature.** Third Edition. Royal 8vo, £3 13*s.* 6*d.*

POOLE, W. F., and FLETCHER, W. I.—**Index to Periodical Literature.** First Supplement. 1882 to 1887. Royal 8vo, £1 16*s.*

Practical Guides.—France, Belgium, Holland, and the Rhine. 1*s.* Italian Lakes. 1*s.* Wintering Places of the South. 2*s.* Switzerland, Savoy, and North Italy. 2*s.* 6*d.* General Continental Guide. 5*s.* Geneva. 1*s.* Paris. 1*s.* Bernese Oberland. 1*s.* Italy. 4*s.*

Psychical Research, Proceedings of the Society for. Published irregularly. Post 8vo. Vol. I. to III. 10*s.* each. Vol. IV. 8*s.* Vol. V. 10*s.*

PURITZ, Ludwig.—**Code-Book of Gymnastic Exercises.** Translated by O. KNOFE and J. W. MACQUEEN. 32mo, 1*s.* 6*d.*

RAPSON, Edward J.—**The Struggle between England and France for Supremacy in India.** Crown 8vo, 4*s.* 6*d.*

RAVENSTEIN, E. G., and HULLEY, John.—**The Gymnasium and its Fittings.** With 14 Plates of Illustrations. 8vo, 2*s.* 6*d.*

READE, Winwood.—**The Martyrdom of Man.** Thirteenth Edition. 8vo, 7*s.* 6*d.*

RENDELL, J. M.—**Concise Handbook of the Island of Madeira.** With Plan of Funchal and Map of the Island. Second Edition. Fcap. 8vo, 1*s.* 6*d.*

RHYS, John.—**Lectures on Welsh Philology.** Second Edition. Crown 8vo, 15*s.*

RIDEAL, C. F.—**Wellerisms, from "Pickwick" and "Master Humphrey's Clock."** 18mo, 2*s.*

RIPPER, William.—**Machine Drawing and Design,** for Engineering Students and Practical Engineers. Illustrated by 55 Plates and numerous Explanatory Notes. Royal 4to, 25*s.*

ROBINSON, A. Mary F.—**The Fortunate Lovers.** Twenty-seven Novels of the Queen of Navarre. Large crown 8vo, 10*s.* 6*d.*

ROLFE, Eustace Neville, and INGLEBY, Holcombe.—**Naples in 1888.** With Illustrations. Crown 8vo, 6*s.*

ROSMINI SERBATI, Antonio.—**Life.** By the Rev. W. LOCKHART. 2 vols. With Portraits. Crown 8vo, 12*s.*

ROSS, Percy.—**A Professor of Alchemy.** Crown 8vo, 3*s.* 6*d.*

ROUTLEDGE, James.—**English Rule and Native Opinion in India.** 8vo, 10*s.* 6*d.*

RULE, Martin, M.A.—**The Life and Times of St. Anselm, Archbishop of Canterbury and Primate of the Britains.** 2 vols. Demy 8vo, 32*s.*

RUTHERFORD, Mark.—**The Autobiography of Mark Rutherford and Mark Rutherford's Deliverance.** Edited by REUBEN SHAPCOTT. Third Edition. Crown 8vo, 7*s.* 6*d.*

The Revolution in Tanner's Lane. Edited by REUBEN SHAPCOTT. Crown 8vo, 7*s.* 6*d.*

Miriam's Schooling: and other Papers. Edited by REUBEN SHAPCOTT. Crown 8vo, 6*s.*

SAMUELSON, James.—**India, Past and Present:** Historical, Social, and Political. With a Map, Explanatory Woodcuts and Collotype Views, Portraits, etc., from 36 Photographs. 8vo, 21*s.*

MUELSON, James—continued.

History of Drink. A Review, Social, Scientific, and Political. Second Edition. 8vo, 6*s.*

Bulgaria, Past and Present: Historical, Political, and Descriptive. With Map and numerous Illustrations. Demy 8vo, 10*s.* 6*d.*

ANDWITH, F. M.—**Egypt as a Winter Resort.** Crown 8vo, 3*s.* 6*d.*

ANTIAGOE, Daniel.—**The Curry Cook's Assistant.** Fcap. 8vo, cloth. 1*s.* 6*d.*; paper covers, 1*s.*

AYCE, Rev. Archibald Henry.—**Introduction to the Science of Language.** New and Cheaper Edition. 2 vols. Crown 8vo, 9*s.*

AYWELL, J. L.—**New Popular Handbook of County Dialects.** Crown 8vo, 5*s.*

CHAIBLE, C. H.—**An Essay on the Systematic Training of the Body.** Crown 8vo, 5*s.*

CHLEICHER, August.—**A Compendium of the Comparative Grammar of the Indo-European, Sanskrit, Greek, and Latin Languages.** Translated from the Third German Edition by HERBERT BENDALL. 2 parts. 8vo, 13*s.* 6*d.*

COONES, W. Baptiste.—**Four Centuries of English Letters:** A Selection of 350 Letters by 150 Writers, from the Period of the Paston Letters to the Present Time. Third Edition. Large crown 8vo, 6*s.*

COTT, Benjamin.—**A State Iniquity: Its Rise, Extension, and Overthrow.** Demy 8vo, plain cloth, 3*s.* 6*d.*; gilt, 5*s.*

ELBY, H. M.—**The Shakespeare Classical Dictionary; or,** Mythological Allusions in the Plays of Shakespeare Explained. Fcap. 8vo, 1*s.*

elwyn, Bishop, *of New Zealand and of Lichfield.* A Sketch of his Life and Work, with Further Gleanings from his Letters, Sermons, and Speeches. By the Rev. Canon CURTEIS. Large crown 8vo, 7*s.* 6*d.*

ERJEANT, W. C. Eldon.—**The Astrologer's Guide (Anima Astrologiæ).** Demy 8vo, 7*s.* 6*d.*

hakspere's Works. The Avon Edition, 12 vols., fcap. 8vo, cloth, 18*s.*; in cloth box, 21*s.*; bound in 6 vols., cloth, 15*s.*

hakspere's Works, an Index to. By EVANGELINE O'CONNOR. Crown 8vo, 5*s.*

HAKESPEARE.—**The Bankside Shakespeare.** The Comedies, Histories, and Tragedies of Mr. William Shakespeare, as presented at the Globe and Blackfriars Theatres, *circa* 1591–1623. Being the Text furnished the Players, in parallel pages with the first revised folio text, with Critical Introductions. 8vo. [*In preparation.*

SHAKESPEARE—continued.

A **New Study of Shakespeare.** An Inquiry into the Connection of the Plays and Poems, with the Origins of the Classical Drama, and with the Platonic Philosophy, through the Mysteries. Demy 8vo, 10*s*. 6*d*.

Shakespeare's Cymbeline. Edited, with Notes, by C. M. INGLEBY. Crown 8vo, 1*s*. 6*d*.

A **New Variorum Edition of Shakespeare.** Edited by HORACE HOWARD FURNESS. Royal 8vo. Vol. I. Romeo and Juliet. 18*s*. Vol. II. Macbeth. 18*s*. Vols. III. and IV. Hamlet. 2 vols. 36*s*. Vol. V. King Lear. 18*s*. Vol. VI. Othello. 18*s*.

Shakspere Society (The New).—Subscription, one guinea per annum. List of Publications on application.

SHELLEY, Percy Bysshe.—**Life.** By EDWARD DOWDEN, LL.D. 2 vols. With Portraits. Demy 8vo, 36*s*.

SIBREE, James, Jun.—**The Great African Island.** Chapters on Madagascar. A Popular Account of the Physical Geography, etc., of the Country. With Physical and Ethnological Maps and 4 Illustrations. 8vo, 10*s*. 6*d*.

SIGERSON, George, M.D.—**Political Prisoners at Home and Abroad.** With Appendix on Dietaries. Crown 8vo, 2*s*. 6*d*.

SIMCOX, Edith.—**Episodes in the Lives of Men, Women, and Lovers.** Crown 8vo, 7*s*. 6*d*.

SINCLAIR, Thomas.—**Essays: in Three Kinds.** Crown 8vo, 1*s*. 6*d*.; wrappers, 1*s*.

Sinclairs of England (The). Crown 8vo, 12*s*.

SINNETT, A. P.—**The Occult World.** Fourth Edition. Crown 8vo, 3*s*. 6*d*.

Incidents in the Life of Madame Blavatsky. Demy 8vo, 10*s*. 6*d*.

Skinner, James: A Memoir. By the Author of "Charles Lowder." With a Preface by the Rev. Canon CARTER, and Portrait. Large crown, 7*s*. 6*d*.

⁂ Also a cheap Edition. With Portrait. Fourth Edition. Crown 8vo, 3*s*. 6*d*.

SMITH, Huntington.—**A Century of American Literature: Benjamin Franklin to James Russell Lowell.** Crown 8vo, 6*s*.

SMITH, S.—**The Divine Government.** Fifth Edition. Crown 8vo, 6*s*.

SMYTH, R. Brough.—**The Aborigines of Victoria.** Compiled for the Government of Victoria. With Maps, Plates, and Woodcuts. 2 vols. Royal 8vo, £3 3*s.*

Sophocles: The Seven Plays in English Verse. Translated by LEWIS CAMPBELL. Crown 8vo, 7*s.* 6*d.*

Specimens of English Prose Style from Malory to Macaulay. Selected and Annotated, with an Introductory Essay, by GEORGE SAINTSBURY. Large crown 8vo, printed on hand-made paper, parchment antique or cloth, 12*s.*; vellum, 15*s.*

SPEDDING, James.—**The Life and Times of Francis Bacon.** 2 vols. Post 8vo, 21*s.*

Spinoza, Benedict de: His Life, Correspondence, and Ethics. By R. WILLIS, M.D. 8vo, 21*s.*

SPRAGUE, Charles E.—**Handbook of Volapük:** The International Language. Second Edition. Crown 8vo, 5*s.*

ST. HILL, Katharine.—**The Grammar of Palmistry.** With 18 Illustrations. 12mo, 1*s.*

STOKES, Whitley.—**Goidelica:** Old and Early-Middle Irish Glosses. Prose and Verse. Second Edition. Med. 8vo, 18*s.*

STRACHEY, Sir John, G.C.S.I.—**India.** With Map. Demy 8vo, 15*s.*

STREET, J. C.—**The Hidden Way across the Threshold;** or, The Mystery which hath been hidden for Ages and from Generations. With Plates. Large 8vo, 15*s.*

SUMNER, W. G.—**What Social Classes owe to Each Other.** 18mo, 3*s.* 6*d.*

SWINBURNE, Algernon Charles.—**A Word for the Navy.** Imperial 16mo, 5*s.*

The Bibliography of Swinburne, 1857-1887. Crown 8vo, vellum gilt, 6*s.*

Sylva, Carmen (Queen of Roumania), **The Life of.** Translated by Baroness DEICHMANN. With 4 Portraits and 1 Illustration. 8vo, 12*s.*

TAYLER, J. J.—**A Retrospect of the Religious Life of England;** or, Church, Puritanism, and Free Inquiry. Second Edition. Post 8vo, 7*s.* 6*d.*

TAYLOR, Rev. Canon Isaac, LL.D.—**The Alphabet.** An Account of the Origin and Development of Letters. With numerous Tables and Facsimiles. 2 vols. Demy 8vo, 36*s.*

Leaves from an Egyptian Note-book. Crown 8vo, 5*s.*

TAYLOR, Sir Henry.—**The Statesman.** Fcap. 8vo, 3*s.* 6*d.*

Taylor, Reynell, C.B., C.S.I.: A Biography. By E. GAMBIER PARRY. With Portait and Map. Demy 8vo, 14*s.*

Technological Dictionary of the Terms employed in the Arts and Sciences; Architecture; Engineering; Mechanics; Shipbuilding and Navigation; Metallurgy; Mathematics, etc. Second Edition. 3 vols. 8vo.

Vol. I. German-English-French. 12*s.*

Vol. II. English-German-French. 12*s.*

Vol. III. French-German-English. 15*s.*

THACKERAY, Rev. S. W., LL.D—**The Land and the Community.** Crown 8vo, 3*s.* 6*d.*

THACKERAY, William Makepeace.—**An Essay on the Genius of George Cruikshank.** Reprinted verbatim from the *Westminster Review.* 40 Illustrations. Large paper Edition. Royal 8vo, 7*s.* 6*d.*

Sultan Stork; and other Stories and Sketches. 1829-1844. Now First Collected. To which is added the Bibliography of Thackeray, Revised and Considerably Enlarged. Large demy 8vo, 10*s.* 6*d.*

THOMPSON, Sir H.—**Diet in Relation to Age and Activity.** Fcap. 8vo, cloth, 1*s.* 6*d.*; paper covers, 1*s.*

Modern Cremation. Crown 8vo, 2*s.* 6*d.*

Tobacco Talk and Smokers' Gossip. 16mo, 2*s.*

TRANT, William.—**Trade Unions: Their Origin, Objects, and Efficacy.** Small crown 8vo, 1*s.* 6*d.*; paper covers, 1*s.*

TRENCH, The late R. C., Archbishop.—**Letters and Memorials.** By the Author of "Charles Lowder." With two Portraits. 2 vols. 8vo, 21*s.*

A Household Book of English Poetry. Selected and Arranged, with Notes. Fourth Edition, Revised. Extra fcap. 8vo, 5*s.*

An Essay on the Life and Genius of Calderon. With Translations from his "Life's a Dream" and "Great Theatre of the World." Second Edition, Revised and Improved. Extra fcap. 8vo, 5*s.* 6*d.*

Gustavus Adolphus in Germany, and other Lectures on the Thirty Years' War. Third Edition, Enlarged. Fcap. 8vo, 4*s.*

Plutarch: his Life, his Lives, and his Morals. Second Edition, Enlarged. Fcap. 8vo, 3*s.* 6*d.*

Remains of the late Mrs. Richard Trench. Being Selections from her Journals, Letters, and other Papers. New and Cheaper Issue. With Portrait. 8vo, 6*s.*

Lectures on Mediæval Church History. Being the Substance of Lectures delivered at Queen's College, London. Second Edition. 8vo, 12*s.*

TRENCH, The late R. C., Archbishop—continued.

English, Past and Present. Thirteenth Edition, Revised and Improved. Fcap. 8vo, 5*s.*

On the Study of Words. Twentieth Edition, Revised. Fcap. 8vo, 5*s.*

Select Glossary of English Words used Formerly in Senses Different from the Present. Seventh Edition, Revised and Enlarged. Fcap. 8vo, 5*s.*

Proverbs and Their Lessons. Seventh Edition, Enlarged. Fcap. 8vo, 4*s.*

TRIMEN, Roland.—**South-African Butterflies.** A Monograph of the Extra-Tropical Species. With 12 Coloured Plates. 3 vols. Demy 8vo, £2 12*s.* 6*d.*

Trübner's Bibliographical Guide to American Literature. A Classed List of Books published in the United States of America, from 1817 to 1857. Edited by NICOLAS TRÜBNER. 8vo, half-bound, 18*s.*

TRUMBULL, H. Clay.—**The Blood-Covenant, a Primitive Rite, and its Bearings on Scripture.** Post 8vo, 7*s.* 6*d.*

TURNER, Charles Edward.—**Count Tolstoï**, as Novelist and Thinker. Lectures delivered at the Royal Institution. Crown 8vo, 3*s.* 6*d.*

The Modern Novelists of Russia. Lectures delivered at the Taylor Institution, Oxford. Crown 8vo, 3*s.* 6*d.*

TWEEDIE, Mrs. Alec.—**The Ober-Ammergau Passion Play, 1890.** Small crown 8vo, 2*s.* 6*d.*

VAUGHAN, H. H.—**British Reason in English Rhyme.** Crown 8vo, 6*s.*

VESCELIUS-SHELDON, Louise.—**An I. D. B. in South Africa.** Illustrated by G. E. GRAVES and AL. HENCKE. Crown 8vo, 7*s.* 6*d.*

Yankee Girls in Zulu-Land. Illustrated by G. E. GRAVES. Crown 8vo, 5*s.*

Victoria Government, Publications of the. [*List in preparation.*

VINCENT, Frank.—**Around and about South America.** Twenty Months of Quest and Query. With Maps, Plans, and 54 Illustrations. Medium 8vo, 21*s.*

WAITE, A. E.—**Lives of Alchemystical Philosophers.** Demy 8vo, 10*s.* 6*d.*

The Magical Writings of Thomas Vaughan. Small 4to, 10*s.* 6*d.*

The Real History of the Rosicrucians. With Illustrations. Crown 8vo, 7*s.* 6*d.*

WAITE, A. E.—continued.

The Mysteries of Magic. A Digest of the Writings of Éliphas Lévi. With Illustrations. Demy 8vo, 10*s.* 6*d.*

WAKE, C. Staniland.—**Serpent-Worship, and other Essays, with a Chapter on Totemism.** Demy 8vo, 10*s.* 6*d.*

The Development of Marriage and Kinship. Demy 8vo, 18*s.*

Wales.—Through North Wales with a Knapsack. By Four Schoolmistresses. With a Sketch Map. Small crown 8vo, 2*s.* 6*d.*

WALL, George.—**The Natural History of Thought in its Practical Aspect, from its Origin in Infancy.** Demy 8vo, 12*s.* 6*d.*

WALLACE, Alfred Russel.—**On Miracles and Modern Spiritualism.** Second Edition. Crown 8vo, 5*s.*

WALPOLE, Chas. George.—**A Short History of Ireland from the Earliest Times to the Union with Great Britain.** With 5 Maps and Appendices. Third Edition. Crown 8vo, 6*s.*

WALTERS, J. Cuming.—**In Tennyson Land.** Being a Brief Account of the Home and Early Surroundings of the Poet-Laureate. With Illustrations. Demy 8vo, 5*s.*

WARTER, J. W.—**An Old Shropshire Oak.** 2 vols. Demy 8vo, 28*s.*

WATSON, R. G.—**Spanish and Portuguese South America during the Colonial Period.** 2 vols. Post 8vo, 21*s.*

WEDGWOOD, H.—**A Dictionary of English Etymology.** Fourth Edition, Revised and Enlarged. With Introduction on the Origin of Language. 8vo, £1 1*s.*

Contested Etymologies in the Dictionary of the Rev. W. W. Skeat. Crown 8vo, 5*s.*

WEDGWOOD, Julia.—**The Moral Ideal.** An Historic Study. Second Edition. Demy 8vo, 9*s.*

WEISBACH, Julius.—**Theoretical Mechanics.** A Manual of the Mechanics of Engineering. Designed as a Text-book for Technical Schools, and for the Use of Engineers. Translated from the German by ECKLEY B. COXE. With 902 Woodcuts. Demy 8vo, 31*s.* 6*d.*

WESTROPP, Hodder M.—**Primitive Symbolism as Illustrated in Phallic Worship**; or, The Reproductive Principle. With an Introduction by Major-Gen. FORLONG. Demy 8vo, parchment, 7*s.* 6*d.*

WHEELDON, J. P.—**Angling Resorts near London.** The Thames and the Lea. Crown 8vo, paper, 1*s.* 6*d.*

WHIBLEY, Chas.—**In Cap and Gown**: Three Centuries of Cambridge Wit. Crown 8vo, 7*s.* 6*d.*

WHITMAN, Sidney.—**Imperial Germany.** A Critical Study of Fact and Character. Crown 8vo, 7*s.* 6*d.*

WIGSTON, W. F. C.—**Hermes Stella**; or, Notes and Jottings on the Bacon Cipher. 8vo, 6*s.*

Wilberforce, Bishop, *of Oxford and Winchester,* **Life.** By his Son REGINALD WILBERFORCE. Crown 8vo, 6*s.*

WILDRIDGE, T. Tyndall.—**The Dance of Death, in Painting and in Print.** With Woodcuts. 4to, 3*s.* 6*d*; the Woodcuts coloured by hand, 5*s.*

WOLTMANN, Dr. Alfred, and WOERMANN, Dr. Karl.—**History of Painting.** With numerous Illustrations. Medium 8vo. Vol. I. Painting in Antiquity and the Middle Ages. 28*s.*; bevelled boards, gilt leaves, 30*s.* Vol. II. The Painting of the Renascence. 42*s.*; bevelled boards, gilt leaves, 45*s.*

WOOD, M. W.—**Dictionary of Volapük.** Volapük-English and English-Volapük. Volapükatidel e cif. Crown 8vo, 10*s.* 6*d.*

WORTHY, Charles.—**Practical Heraldry**; or, An Epitome of English Armory. 124 Illustrations. Crown 8vo, 7*s.* 6*d.*

WRIGHT, Thomas.—**The Homes of Other Days.** A History of Domestic Manners and Sentiments during the Middle Ages. With Illustrations from the Illuminations in Contemporary Manuscripts and other Sources. Drawn and Engraved by F. W. FAIRHOLT, F.S.A. 350 Woodcuts. Medium 8vo, 21*s.*

Anglo-Saxon and Old English Vocabularies. Second Edition. Edited by RICHARD PAUL WULCKER. 2 vols. Demy 8vo, 28*s.*

The Celt, the Roman, and the Saxon. A History of the Early Inhabitants of Britain down to the Conversion of the Anglo-Saxons to Christianity. Illustrated by the Ancient Remains brought to light by Recent Research. Corrected and Enlarged Edition. With nearly 300 Engravings. Crown 8vo, 9*s.*

YELVERTON, Christopher.—**Oneiros**; or, Some Questions of the Day. Crown 8vo, 5*s.*

THEOLOGY AND PHILOSOPHY.

ALEXANDER, William, D.D., Bishop of Derry.—**The Great Question,** and other Sermons. Crown 8vo, 6*s.*

AMBERLEY, Viscount.—**An Analysis of Religious Belief.** 2 vols. Demy 8vo, 30*s.*

Antiqua Mater: A Study of Christian Origins. Crown 8vo, 7*s.* 6*d.*

BELANY, Rev. R.—**The Bible and the Papacy.** Crown 8vo, 2*s.*

BENTHAM, Jeremy.—**Theory of Legislation.** Translated from the French of Etienne Dumont by R. HILDRETH. Fifth Edition. Post 8vo, 7*s.* 6*d.*

BEST, George Payne.—**Morality and Utility.** A Natural Science of Ethics. Crown 8vo, 5*s.*

BROOKE, Rev. Stopford A.—**The Fight of Faith.** Sermons preached on various occasions. Fifth Edition. Crown 8vo, 7*s.* 6*d.*

The Spirit of the Christian Life. Third Edition. Crown 8vo, 5*s.*

Theology in the English Poets. Cowper, Coleridge, Wordsworth, and Burns. Sixth Edition. Post 8vo, 5*s.*

Christ in Modern Life. Seventeenth Edition. Crown 8vo, 5*s.*

Sermons. First Series. Thirteenth Edition. Crown 8vo, 5*s.*

Sermons. Second Series. Sixth Edition. Crown 8vo, 5*s.*

BROWN, Rev. J. Baldwin.—**The Higher Life.** Its Reality, Experience, and Destiny. Seventh Edition. Crown 8vo, 5*s.*

Doctrine of Annihilation in the Light of the Gospel of Love. Five Discourses. Fourth Edition. Crown 8vo, 2*s.* 6*d.*

The Christian Policy of Life. A Book for Young Men of Business. Third Edition. Crown 8vo, 3*s.* 6*d.*

BUNSEN, Ernest de.—**Islam**; or, True Christianity. Crown 8vo, 5s.

Catholic Dictionary. Containing some Account of the Doctrine, Discipline, Rites, Ceremonies, Councils, and Religious Orders of the Catholic Church. Edited by THOMAS ARNOLD, M.A. Third Edition. Demy 8vo, 21*s.*

CHEYNE, Canon.—**The Prophecies of Isaiah.** Translated with Critical Notes and Dissertations. 2 vols. Fifth Edition. Demy 8vo, 25*s.*

Job and Solomon; or, The Wisdom of the Old Testament. Demy 8vo, 12*s.* 6*d.*

The Psalms; or, Book of The Praises of Israel. Translated with Commentary. Demy 8vo. 16*s.*

CLARKE, James Freeman.—**Ten Great Religions.** An Essay in Comparative Theology. Demy 8vo, 10*s.* 6*d.*

Ten Great Religions. Part II. A Comparison of all Religions. Demy 8vo, 10*s.* 6*d.*

COKE, Henry.—**Creeds of the Day**; or, Collated Opinions of Reputable Thinkers. 2 vols. Demy 8vo, 21*s.*

OMTE, Auguste.—**The Catechism of Positive Religion.** Translated from the French by Richard Congreve. Second Edition. Crown 8vo, 2*s.* 6*d.*

The Eight Circulars of Auguste Comte. Translated from the French. Fcap. 8vo, 1*s.* 6*d.*

Appeal to Conservatives. Crown 8vo, 2*s.* 6*d.*

The Positive Philosophy of Auguste Comte. Translated and condensed by Harriet Martineau. 2 vols. Second Edition. 8vo, 25*s.*

ONWAY, Moncure D.—**The Sacred Anthology.** A Book of Ethnical Scriptures. Edited by Moncure D. Conway. New Edition. Crown 8vo, 5*s.*

Idols and Ideals. With an Essay on Christianity. Crown 8vo, 4*s.*

OX, Rev. Samuel, D.D.—**A Commentary on the Book of Job.** With a Translation. Second Edition. Demy 8vo, 15*s.*

Salvator Mundi; or, Is Christ the Saviour of all Men? Twelfth Edition. Crown 8vo, 2*s.* 6*d.*

The Larger Hope. A Sequel to "Salvator Mundi." Second Edition. 16mo, 1*s.*

The Genesis of Evil, and other Sermons, mainly expository. Third Edition. Crown 8vo, 6*s.*

Balaam. An Exposition and a Study. Crown 8vo, 5*s.*

Miracles. An Argument and a Challenge. Crown 8vo, 2*s.* 6*d.*

RANBROOK, James.—**Credibilia**; or, Discourses on Questions of Christian Faith. Post 8vo, 3*s.* 6*d.*

The Founders of Christianity; or, Discourses upon the Origin of the Christian Religion. Post 8vo, 6*s.*

AWSON, Geo., M.A.—**Prayers, with a Discourse on Prayer.** Edited by his Wife. First Series. Tenth Edition. Small Crown 8vo, 3*s.* 6*d.*

Prayers, with a Discourse on Prayer. Edited by George St. Clair, F.G.S. Second Series. Small Crown 8vo, 3*s.* 6*d.*

Sermons on Disputed Points and Special Occasions. Edited by his Wife. Fourth Edition. Crown 8vo, 3*s.* 6*d.*

Sermons on Daily Life and Duty. Edited by his Wife. Fifth Edition. Small crown 8vo, 3*s.* 6*d.*

The Authentic Gospel, and other Sermons. Edited by George St. Clair, F.G.S. Third Edition. Crown 8vo, 6*s.*

Every-day Counsels. Edited by George St. Clair, F.G.S. Crown 8vo, 6*s.*

DELEPIERRE, Octave.—**L'Enfer:** Essai Philosophique et Historique sur les Légendes de la Vie Future. Only 250 copies printed. Crown 8vo, 6*s.*

Doubter's Doubt about Science and Religion. Crown 8vo, 3*s.* 6*d.*

FICHTE, Johann Gottlieb.—**Characteristics of the Present Age.** Translated by WILLIAM SMITH. Post 8vo, 6*s.*

Memoir of Johann Gottlieb Fichte. By WILLIAM SMITH. Second Edition. Post 8vo, 4*s.*

On the Nature of the Scholar, and its Manifestations. Translated by WILLIAM SMITH. Second Edition. Post 8vo, 3*s.*

New Exposition of the Science of Knowledge. Translated by A. E. KROEGER. 8vo, 6*s.*

FITZ-GERALD, Mrs. P. F.—**A Protest against Agnosticism:** Introduction to a New Theory of Idealism. Demy 8vo.

An Essay on the Philosophy of Self-Consciousness. Comprising an Analysis of Reason and the Rationale of Love. Demy 8vo, 5*s.*

A Treatise on the Principle of Sufficient Reason. A Psychological Theory of Reasoning, showing the Relativity of Thought to the Thinker, of Recognition to Cognition, the Identity of Presentation and Representation, of Perception and Apperception. Demy 8vo, 6*s.*

GALLWEY, Rev. P.—**Apostolic Succession.** A Handbook. Demy 8vo, 1*s.*

GOUGH, Edward.—**The Bible True from the Beginning.** A Commentary on all those Portions of Scripture that are most Questioned and Assailed. Vols. I., II., and III. Demy 8vo, 16*s.* each.

GREG, W. R.—**Literary and Social Judgments.** Fourth Edition. 2 vols. Crown 8vo, 15*s.*

The Creed of Christendom. Eighth Edition. 2 vols. Post 8vo, 15*s.*

Enigmas of Life. Seventeenth Edition. Post 8vo, 10*s.* 6*d.*

Political Problems for our Age and Country. Demy 8vo, 10*s.* 6*d.*

Miscellaneous Essays. 2 Series. Crown 8vo, 7*s.* 6*d.* each.

GRIMLEY, Rev. H. N., M.A.—**Tremadoc Sermons, chiefly on the Spiritual Body, the Unseen World, and the Divine Humanity.** Fourth Edition. Crown 8vo, 6*s.*

The Temple of Humanity, and other Sermons. Crown 8vo, 6*s.*

URNEY, Alfred.—**Our Catholic Inheritance in the Larger Hope.** Crown 8vo, 1*s.* 6*d.*

AINES, C. R.—**Christianity and Islam in Spain, A.D. 756-1031.** Crown 8vo, 2*s.* 6*d.*

AWEIS, Rev. H. R., M.A.—**Current Coin.** Materialism—The Devil—Crime—Drunkenness—Pauperism—Emotion—Recreation—The Sabbath. Fifth Edition. Crown 8vo, 5*s.*

Arrows in the Air. Fifth Edition. Crown 8vo, 5*s.*

Speech in Season. Sixth Edition. Crown 8vo, 5*s.*

Thoughts for the Times. Fourteenth Edition. Crown 8vo, 5*s.*

Unsectarian Family Prayers. New Edition. Fcap. 8vo, 1*s.* 6*d.*

UGHES, Rev. H., M.A.—**Principles of Natural and Supernatural Morals.** Vol. I. Natural Morals. Demy 8vo, 12*s.*

OSEPH, N. S.—**Religion, Natural and Revealed.** A Series of Progressive Lessons for Jewish Youth. Crown 8vo, 3*s.*

EMPIS, Thomas à.—**Of the Imitation of Christ.** Parchment Library Edition.—Parchment or cloth, 6*s.*; vellum, 7*s.* 6*d.* The Red Line Edition, fcap. 8vo, cloth extra, 2*s.* 6*d.* The Cabinet Edition, small 8vo, cloth limp, 1*s.*; cloth boards, 1*s.* 6*d.* The Miniature Edition, cloth limp, 32mo, 1*s.*; or with red lines, 1*s.* 6*d.*

Of the Imitation of Christ. A Metrical Version. By HENRY CARRINGTON. Crown 8vo, 5*s.*

Notes of a Visit to the Scenes in which his Life was spent. With numerous Illustrations. By F. R. CRUISE, M.D. Demy 8vo, 12*s.*

eys of the Creeds (The). Third Revised Edition. Crown 8vo, 2*s.* 6*d.*

EWES, George Henry.—**Problems of Life and Mind.** Demy 8vo. First Series: The Foundations of a Creed. 2 vols. 28*s.* Second Series: The Physical Basis of Mind. With Illustrations. 16*s.* Third Series. 2 vols. 22*s.* 6*d.*

EWIS, Harry S.—**Targum on Isaiah i.-v.** With Commentary. Demy 8vo, 5*s.*

ANNING, Cardinal.—**Towards Evening.** Selections from his Writings. Third Edition. 16mo, 2*s.*

ARTINEAU, James.—**Essays, Philosophical and Theological.** 2 vols. Crown 8vo, £1 4*s.*

EAD, C. M., D.D.—**Supernatural Revelation.** An Essay concerning the Basis of the Christian Faith. Royal 8vo, 14*s.*

editations on Death and Eternity. Translated from the German by FREDERICA ROWAN. Published by Her Majesty's gracious permission. Crown 8vo, 6*s.*

Meditations on Life and its Religious Duties. Translated from the German by FREDERICA ROWAN. Published by Her Majesty's gracious permission. Being the Companion Volume to "Meditations on Death and Eternity." Crown 8vo, 6*s.*

NEVILL, F.—**Retrogression or Development.** Crown 8vo, 3*s.* 6*d.*

NICHOLS, J. Broadhurst, and DYMOND, Charles William.—**Practical Value of Christianity.** Two Prize Essays. Crown 8vo, 3*s.* 6*d.*

PARKER, Theodore. — **Discourse on Matters pertaining to Religion.** People's Edition. Crown 8vo, 1*s.* 6*d.*; cloth, 2*s.*

The Collected Works of Theodore Parker, Minister of the Twenty-eighth Congregational Society at Boston, U.S. In 14 vols. 8vo, 6*s.* each.

Vol. I. Discourse on Matters pertaining to Religion. II. Ten Sermons and Prayers. III. Discourses on Theology. IV. Discourses on Politics. V. and VI. Discourses on Slavery. VII. Discourses on Social Science. VIII. Miscellaneous Discourses. IX. and X. Critical Writings. XI. Sermons on Theism, Atheism, and Popular Theology. XII. Autobiographical and Miscellaneous Pieces. XIII. Historic Americans. XIV. Lessons from the World of Matter and the World of Man.

Plea for Truth in Religion. Crown 8vo, 2*s.* 6*d*

Psalms of the West. Small crown 8vo, 5*s.*

Pulpit Commentary, The. (*Old Testament Series.*) Edited by the Rev. J. S. EXELL, M.A., and the Very Rev. Dean H. D. M. SPENCE, M.A., D.D.

Genesis. By the Rev. T. WHITELAW, D.D. With Homilies by the Very Rev. J. F. MONTGOMERY, D.D., Rev. Prof. R. A. REDFORD, M.A., LL.B., Rev. F. HASTINGS, Rev. W. ROBERTS, M.A. An Introduction to the Study of the Old Testament by the Venerable Archdeacon FARRAR, D.D., F.R.S.; and Introductions to the Pentateuch by the Right Rev. H. COTTERILL, D.D., and Rev. T. WHITELAW, D.D. Ninth Edition. 1 vol., 15*s.*

Exodus. By the Rev. Canon RAWLINSON. With Homilies by the Rev. J. ORR, D.D., Rev. D. YOUNG, B.A., Rev. C. A. GOODHART, Rev. J. URQUHART, and the Rev. H. T. ROBJOHNS. Fourth Edition. 2 vols., 9*s.* each.

Leviticus. By the Rev. Prebendary MEYRICK, M.A. With Introductions by the Rev. R. COLLINS, Rev. Professor A. CAVE, and Homilies by the Rev. Prof. REDFORD, LL.B., Rev. J. A. MACDONALD, Rev. W. CLARKSON, B.A., Rev. S. R. ALDRIDGE, LL.B., and Rev. MCCHEYNE EDGAR. Fourth Edition. 15*s.*

pit Commentary, The—*continued.*

Numbers. By the Rev. R. WINTERBOTHAM, LL.B. With Homilies by the Rev. Professor W. BINNIE, D.D., Rev. E. S. PROUT, M.A., Rev. D. YOUNG, B.A., Rev. J. WAITE, B.A., and an Introduction by the Rev. THOMAS WHITELAW, D.D. Fifth Edition. 15*s.*

Deuteronomy. By the Rev. W. L. ALEXANDER, D.D. With Homilies by the Rev. C. CLEMANCE, D.D., Rev. J. ORR, D.D., Rev. R. M. EDGAR, M.A., Rev. D. DAVIES, M.A. Fourth edition. 15*s.*

Joshua. By the Rev. J. J. LIAS, M.A. With Homilies by the Rev. S. R. ALDRIDGE, LL.B., Rev. R. GLOVER, Rev. E. DE PRESSENSÉ, D.D., Rev. J. WAITE, B.A., Rev. W. F. ADENEY, M.A.; and an Introduction by the Rev. A. PLUMMER, D.D. Fifth Edition. 12*s.* 6*d.*

Judges and Ruth. By the Bishop of BATH and WELLS, and Rev. J. MORISON, D.D. With Homilies by the Rev. A. F. MUIR, M.A., Rev. W. F. ADENEY, M.A., Rev. W. M. STATHAM, and Rev. Professor J. THOMSON, M.A. Fifth Edition. 10*s.* 6*d.*

1 and 2 Samuel. By the Very Rev. R. P. SMITH, D.D. With Homilies by the Rev. DONALD FRASER, D.D., Rev. Prof. CHAPMAN, Rev. B. DALE, and Rev. G. WOOD, B.A. Seventh Edition. 15*s.* each.

1 Kings. By the Rev. JOSEPH HAMMOND, LL.B. With Homilies by the Rev. E. DE PRESSENSÉ, D.D., Rev. J. WAITE, B.A., Rev. A. ROWLAND, LL.B., Rev. J. A. MACDONALD, and Rev. J. URQUHART. Fifth Edition. 15*s.*

2 Kings. By the Rev. Canon RAWLINSON. With Homilies by the Rev. J. ORR, D.D., Rev. D. THOMAS, D.D., and Rev. C. H. IRWIN, M.A. 15*s.*

1 Chronicles. By the Rev. Prof. P. C. BARKER, M.A., LL.B. With Homilies by the Rev. Prof. J. R. THOMSON, M.A., Rev. R. TUCK, B.A., Rev. W. CLARKSON, B.A., Rev. F. WHITFIELD, M.A., and Rev. RICHARD GLOVER. 15*s.*

Ezra, Nehemiah, and Esther. By the Rev. Canon G. RAWLINSON, M.A. With Homilies by the Rev. Prof. J. R. THOMSON, M.A., Rev. Prof. R. A. REDFORD, LL.B., M.A., Rev. W. S. LEWIS, M.A., Rev. J. A. MACDONALD, Rev. A. MACKENNAL, B.A., Rev. W. CLARKSON, B.A., Rev. F. HASTINGS, Rev. W. DINWIDDIE, LL.B., Rev. Prof. ROWLANDS, B.A., Rev. G. WOOD, B.A., Rev. Prof. P. C. BARKER, M.A., LL.B., and the Rev. J. S. EXELL, M.A. Seventh Edition. 1 vol., 12*s.* 6*d.*

Isaiah. By the Rev. Canon G. RAWLINSON, M.A. With Homilies by the Rev. Prof. E. JOHNSON, M.A., Rev. W. CLARKSON, B.A., Rev. W. M. STATHAM, and Rev. R. TUCK, B.A. Second Edition. 2 vols., 15*s.* each.

Pulpit Commentary, The—*continued.*

Jeremiah. (Vol. I.) By the Rev. Canon T. K. Cheyne, D.D. With Homilies by the Rev. W. F. Adeney, M.A., Rev. A. F. Muir, M.A., Rev. S. Conway, B.A., Rev. J. Waite, B.A., and Rev. D. Young, B.A. Third Edition. 15*s.*

Jeremiah (Vol. II.) and Lamentations. By the Rev. Canon T. K. Cheyne, D.D. With Homilies by the Rev. Prof. J. R. Thomson, M.A., Rev. W. F. Adeney, M.A., Rev. A. F. Muir, M.A., Rev. S. Conway, B.A., Rev. D. Young, B.A. 15*s.*

Hosea and Joel. By the Rev. Prof. J. J. Given, Ph.D., D.D. With Homilies by the Rev. Prof. J. R. Thomson, M.A., Rev. A. Rowland, B.A., LL.B., Rev. C. Jerdan, M.A., LL.B., Rev. J. Orr, D.D., and Rev. D. Thomas, D.D. 15*s.*

Pulpit Commentary, The. (*New Testament Series.*)

St. Mark. By the Very Rev. E. Bickersteth, D.D., Dean of Lichfield. With Homilies by the Rev. Prof. Thomson, M.A., Rev. Prof. J. J. Given, Ph.D., D.D., Rev. Prof. Johnson, M.A., Rev. A. Rowland, B.A., LL.B., Rev. A. Muir, and Rev. R. Green. Fifth Edition. 2 vols., 10*s.* 6*d.* each.

St. Luke. By the Very Rev. H. D. M. Spence. With Homilies by the Rev. J. Marshall Lang, D.D., Rev. W. Clarkson, B.A., and Rev. R. M. Edgar, M.A. 2 vols., 10*s.* 6*d.* each.

St. John. By the Rev. Prof. H. R. Reynolds, D.D. With Homilies by the Rev. Prof. T. Croskery, D.D., Rev. Prof. J. R. Thomson, M.A., Rev. D. Young, B.A., Rev. B. Thomas, Rev. G. Brown. Second Edition. 2 vols., 15*s.* each.

The Acts of the Apostles. By the Bishop of Bath and Wells. With Homilies by the Rev. Prof. P. C. Barker, M.A., LL.B., Rev. Prof. E. Johnson, M.A., Rev. Prof. R. A. Redford, LL.B., Rev. R. Tuck, B.A., Rev. W. Clarkson, B.A. Fourth Edition. 2 vols., 10*s.* 6*d.* each.

1 Corinthians. By the Ven. Archdeacon Farrar, D.D. With Homilies by the Rev. Ex-Chancellor Lipscomb, LL.D., Rev. David Thomas, D.D., Rev. D. Fraser, D.D., Rev. Prof. J. R. Thomson, M.A., Rev. J. Waite, B.A., Rev. R. Tuck, B.A., Rev. E. Hurndall, M.A., and Rev. H. Bremner, B.D. Fourth Edition. 15*s.*

2 Corinthians and Galatians. By the Ven. Archdeacon Farrar, D.D., and Rev. Prebendary E. Huxtable. With Homilies by the Rev. Ex-Chancellor Lipscomb, LL.D., Rev. David Thomas, D.D., Rev. Donald Fraser, D.D., Rev. R. Tuck, B.A., Rev. E. Hurndall, M.A., Rev. Prof. J. R. Thomson, M.A., Rev. R. Finlayson, B.A., Rev. W. F. Adeney, M.A., Rev. R. M. Edgar, M.A., and Rev. T. Croskery, D.D. Second Edition. 21*s.*

ulpit Commentary, The—*continued.*

Ephesians, Philippians, and Colossians. By the Rev. Prof. W. G. Blaikie, D.D., Rev. B. C. Caffin, M.A., and Rev. G. G. Findlay, B.A. With Homilies by the Rev. D. Thomas, D.D., Rev. R. M. Edgar, M.A., Rev. R. Finlayson, B.A., Rev. W. F. Adeney, M.A., Rev. Prof. T. Croskery, D.D., Rev. E. S. Prout, M.A., Rev. Canon Vernon Hutton, and Rev. U. R. Thomas, D.D. Second Edition. 21*s.*

Thessalonians, Timothy, Titus, and Philemon. By the Bishop of Bath and Wells, Rev. Dr. Gloag, and Rev. Dr. Eales. With Homilies by the Rev. B. C. Caffin, M.A., Rev. R. Finlayson, B.A., Rev. Prof. T. Croskery, D.D., Rev. W. F. Adeney, M.A., Rev. W. M. Statham, and Rev. D. Thomas, D.D. 15*s.*

Hebrews and James. By the Rev. J. Barmby, D.D., and Rev. Prebendary E. C. S. Gibson, M.A. With Homiletics by the Rev. C. Jerdan, M.A., LL.B., and Rev. Prebendary E. C. S. Gibson. And Homilies by the Rev. W. Jones, Rev. C. New, Rev. D. Young, B.A., Rev. J. S. Bright, Rev. T. F. Lockyer, B.A., and Rev. C. Jerdan, M.A., LL.B. Second Edition. 15*s.*

Peter, John, and Jude. By the Rev. B. C. Caffin, M.A., Rev. A. Plummer, D.D., and Rev. S. D. F. Salmond, D.D. With Homilies by the Rev. A. Maclaren, D.D., Rev. C. Clemance, D.D., Rev. Prof. J. R. Thomson, M.A., Rev. C. New, Rev. U. R. Thomas, Rev. R. Finlayson, B.A., Rev. W. Jones, Rev. Prof. T. Croskery, D.D., and Rev. J. S. Bright, D.D. 15*s.*

Revelation. Introduction by the Rev. T. Randell, B.D., Principal of Bede College, Durham; and Exposition by the Rev. T. Randell, assisted by the Rev. A. Plummer, M.A., D.D., Principal of University College, Durham, and A. T. Bott, M.A. With Homilies by the Rev. C. Clemance, D.D., Rev. S. Conway, B.A., Rev. R. Green, and Rev. D. Thomas, D.D.

USEY, Dr.—**Sermons for the Church's Seasons from Advent to Trinity.** Selected from the Published Sermons of the late Edward Bouverie Pusey, D.D. Crown 8vo, 5*s.*

ENAN, Ernest.—**Philosophical Dialogues and Fragments.** From the French. Post 8vo, 7*s.* 6*d.*

An Essay on the Age and Antiquity of the Book of Nabathæan Agriculture. Crown 8vo, 3*s.* 6*d.*

The Life of Jesus. Crown 8vo, cloth, 1*s.* 6*d.*; paper covers, 1*s.*

The Apostles. Crown 8vo, cloth, 1*s.* 6*d.*; paper covers, 1*s.*

EYNOLDS, Rev. J. W.—**The Supernatural in Nature.** A Verification by Free Use of Science. Third Edition, Revised and Enlarged. Demy 8vo, 14*s.*

REYNOLDS, Rev. J. W.—continued.

The Mystery of Miracles. Third and Enlarged Edition. Crown 8vo, 6*s*.

The Mystery of the Universe our Common Faith. Demy 8vo, 14*s*.

The World to Come: Immortality a Physical Fact. Crown 8vo, 6*s*.

RICHARDSON, Austin.—**"What are the Catholic Claims?"** With Introduction by Rev. LUKE RIVINGTON. Crown 8vo, 3*s*. 6*d*.

RIVINGTON, Luke.—**Authority, or a Plain Reason for joining the Church of Rome.** Fifth Edition. Crown 8vo, 3*s*. 6*d*.

Dependence; or, The Insecurity of the Anglican Position. Crown 8vo, 5*s*.

ROBERTSON, The late Rev. F. W., M.A.—**Life and Letters of.** Edited by the Rev. STOPFORD BROOKE, M.A.

I. Two vols., uniform with the Sermons. With Steel Portrait. Crown 8vo, 7*s*. 6*d*.
II. Library Edition, in Demy 8vo, with Portrait. 12*s*.
III. A Popular Edition, in 1 vol. Crown 8vo, 6*s*.

Sermons. Five Series. Small crown 8vo, 3*s*. 6*d*. each.

Notes on Genesis. New and Cheaper Edition. Small crown 8vo, 3*s*. 6*d*.

Expository Lectures on St. Paul's Epistles to the Corinthians. A New Edition. Small crown 8vo, 5*s*.

Lectures and Addresses, with other Literary Remains. A New Edition. Small crown 8vo, 5*s*.

An Analysis of Tennyson's "In Memoriam." (Dedicated by Permission to the Poet-Laureate.) Fcap. 8vo, 2*s*.

The Education of the Human Race. Translated from the German of GOTTHOLD EPHRAIM LESSING. Fcap. 8vo, 2*s*. 6*d*.

⁂ A Portrait of the late Rev. F. W. Robertson, mounted for framing, can be had, 2*s*. 6*d*.

SCANNELL, Thomas B., B.D., and WILHELM, Joseph, D.D.—**A Manual of Catholic Theology.** Based on SCHEEBEN'S "Dogmatik." 2 vols. Demy 8vo. Vol. I., 15*s*.

SHEEPSHANKS, Rev. J.—**Confirmation and Unction of the Sick.** Small crown 8vo, 3*s*. 6*d*.

STEPHEN, Caroline E.—**Quaker Strongholds.** Crown 8vo, 5*s*.

Theology and Piety alike Free; from the Point of View of Manchester New College, Oxford. A Contribution to its effort offered by an old Student. Demy 8vo, 9*s*.

TRENCH, Archbishop.—**Notes on the Parables of Our Lord.** 8vo, 12*s.* Cheap Edition. Fifty-sixth Thousand. 7*s.* 6*d.*

Notes on the Miracles of Our Lord. 8vo, 12*s.* Cheap Edition. Forty-eighth Thousand. 7*s.* 6*d.*

Studies in the Gospels. Fifth Edition, Revised. 8vo, 10*s.* 6*d.*

Brief Thoughts and Meditations on Some Passages in Holy Scripture. Third Edition. Crown 8vo, 3*s.* 6*d.*

Synonyms of the New Testament. Tenth Edition, Enlarged. 8vo, 12*s.*

Sermons New and Old. Crown 8vo, 6*s.*

Westminster and other Sermons. Crown 8vo, 6*s.*

On the Authorized Version of the New Testament. Second Edition. 8vo, 7*s.*

Commentary on the Epistles to the Seven Churches in Asia. Fourth Edition, Revised. 8vo, 8*s.* 6*d.*

The Sermon on the Mount. An Exposition drawn from the Writings of St. Augustine, with an Essay on his Merits as an Interpreter of Holy Scripture. Fourth Edition, Enlarged. 8vo, 10*s.* 6*d.*

Shipwrecks of Faith. Three Sermons preached before the University of Cambridge in May, 1867. Fcap. 8vo, 2*s.* 6*d.*

TRINDER, Rev. D.—**The Worship of Heaven, and other Sermons.** Crown 8vo, 5*s.*

WARD, Wilfrid.—**The Wish to Believe.** A Discussion Concerning the Temper of Mind in which a reasonable Man should undertake Religious Inquiry. Small crown 8vo, 5*s.*

WARD, William George, Ph.D.—**Essays on the Philosophy of Theism.** Edited, with an Introduction, by WILFRID WARD. 2 vols. Demy 8vo, 21*s.*

What is Truth? A Consideration of the Doubts as to the Efficacy of Prayer, raised by Evolutionists, Materialists, and others. By "Nemo."

WILHELM, Joseph, D.D., and SCANNELL, Thomas B., B.D.—**A Manual of Catholic Theology.** Based on SCHEEBEN'S "Dogmatik." 2 vols. Demy 8vo. Vol. I., 15*s.*

WYNELL-MAYOW, S. S.—**The Light of Reason.** Crown 8vo, 5*s.*

ENGLISH AND FOREIGN PHILOSOPHICAL LIBRARY.

Auguste Comte and Positivism. By the late JOHN STUART MILL. Third Edition. 3*s.* 6*d.*

Candid Examination of Theism (A). By PHYSICUS. Second Edition. 7*s.* 6*d.*

Colour-Sense (The): Its Origin and Development. An Essay in Comparative Psychology. By GRANT ALLEN. 10*s.* 6*d.*

Contributions to the History of the Development of the Human Race. Lectures and Dissertations. By LAZARUS GEIGER. Translated from the German by D. ASHER. 6*s.*

Creed of Christendom (The). Its Foundations contrasted with its Superstructure. By W. R. GREG. Eighth Edition. 2 vols. 15*s.*

Dr. Appleton: His Life and Literary Relics. By J. H. APPLETON and A. H. SAYCE. 10*s.* 6*d.*

Edgar Quinet: His Early Life and Writings. By RICHARD HEATH. With Portraits, Illustrations, and an Autograph Letter. 12*s.* 6*d.*

Emerson at Home and Abroad. By M. D. CONWAY. With Portrait. 10*s.* 6*d.*

Enigmas of Life. By W. R. GREG. Seventeenth Edition. 10*s.* 6*d.*

Essays and Dialogues of Giacomo Leopardi. Translated by CHARLES EDWARDES. With Biographical Sketch. 7*s.* 6*d.*

Essence of Christianity (The). By L. FEUERBACH. Translated from the German by MARIAN EVANS. Second Edition. 7*s.* 6*d.*

Ethic Demonstrated in Geometrical Order and Divided into Five Parts, which treat (1) Of God, (2) Of the Nature and Origin of the Mind, (3) Of the Origin and Nature of the Affects, (4) Of Human Bondage, or of the Strength of the Affects, (5) Of the Power of the Intellect, or of Human Liberty. By BENEDICT DE SPINOZA. Translated from the Latin by WILLIAM HALE WHITE. 10*s.* 6*d.*

Guide of the Perplexed of Maimonides (The). Translated from the Original Text and Annotated by M. FRIEDLANDER. 3 vols. 31*s.* 6*d.*

History of Materialism (A), and Criticism of its present Importance. By Prof. F. A. LANGE. Authorized Translation from the German by ERNEST C. THOMAS. In 3 vols. 10*s.* 6*d.* each.

Johann Gottlieb Fichte's Popular Works. The Nature of the Scholar; The Vocation of the Scholar; The Vocation of Man; The Doctrine of Religion; Characteristics of the Present Age; Outlines of the Doctrine of Knowledge. With a Memoir by WILLIAM SMITH, LL.D. 2 vols. 21*s.*

Moral Order and Progress. An Analysis of Ethical Conceptions. By S. ALEXANDER. 14*s.*

Natural Law. An Essay in Ethics. By EDITH SIMCOX. Second Edition. 10*s.* 6*d.*

Outlines of the History of Religion to the Spread of the Universal Religions. By Prof. C. P. TIELE. Translated from the Dutch by J. ESTLIN CARPENTER. Fourth Edition. 7*s.* 6*d.*

Philosophy of Law (The). By Prof. DIODATO LIOY. Translated by W. HASTIE.

Philosophy of Music (The). Lectures delivered at the Royal Institution of Great Britain. By WILLIAM POLE, F.R.S. Second Edition. 7*s.* 6*d.*

Philosophy of the Unconscious (The). By EDUARD VON HARTMANN. Translated by WILLIAM C. COUPLAND. 3 vols. 31*s.* 6*d.*

Religion and Philosophy in Germany. A Fragment. By HEINRICH HEINE. Translated by J. SNODGRASS. 6*s.*

Religion in China. Containing a brief Account of the Three Religions of the Chinese; with Observations on the Prospects of Christian Conversion amongst that People. By JOSEPH EDKINS, D.D. Third Edition. 7*s.* 6*d.*

Science of Knowledge (The). By J. G. FICHTE. Translated from the German by A. E. KROEGER. With an Introduction by Prof. W. T. HARRIS. 10*s.* 6*d.*

Science of Rights (The). By J. G. FICHTE. Translated from the German by A. E. KROEGER. With an Introduction by Prof. W. T. HARRIS. 12*s.* 6*d.*

World as Will and Idea (The). By ARTHUR SCHOPENHAUER. Translated from the German by R. B. HALDANE and JOHN KEMP. 3 vols. £2 10*s.*

Extra Series.

An Account of the Polynesian Race: Its Origin and Migrations, and the Ancient History of the Hawaiian People. By ABRAHAM FORNANDER. 3 vols. 27*s.*

Lessing: His Life and Writings. By JAMES SIME. Second Edition. 2 vols. With Portraits. 21*s.*

Oriental Religions, and their Relation to Universal Religion—India. By SAMUEL JOHNSON. 2 vols. 21*s.*

SCIENCE.

BADER, C.—**The Natural and Morbid Changes of the Human Eye, and their Treatment.** Medium 8vo, 16*s*.

Plates illustrating the Natural and Morbid Changes of the Human Eye. With Explanatory Text. Medium 8vo, in a portfolio, 21*s*. Price for Text and Atlas taken together, £1 12*s*.

BICKNELL, C.—**Flowering Plants and Ferns of the Riviera and Neighbouring Mountains.** Drawn and described by C. BICKNELL. With 82 full-page Plates, containing Illustrations of 350 Specimens. Imperial 8vo, half-roan, gilt edges, £3 3*s*.

BLATER, Joseph.—**Table of Quarter-Squares of all Whole Numbers from 1 to 200,000.** For Simplifying Multiplication, Squaring, and Extraction of the Square Root. Royal 4to, half-bound, 21*s*.

Table of Napier. Giving the Nine Multiples of all Numbers. Cloth case, 1*s*. 3*d*.

BROWNE, Edgar A.—**How to use the Ophthalmoscope.** Being Elementary Instruction in Ophthalmoscopy. Third Edition. Crown 8vo, 3*s*. 6*d*.

BUNGE, G.—**Text-Book of Physiological and Pathological Chemistry.** For Physicians and Students. Translated from the German by L. C. WOODBRIDGE, M.D. Demy 8vo, 16*s*.

CALLEJA, Camilo, M.D.—**Principles of Universal Physiology.** Crown 8vo, 3*s*. 6*d*.

CANDLER, C.—**The Prevention of Consumption:** A New Theory of the Nature of the Tubercle-Bacillus. Demy 8vo, 10*s*. 6*d*.

The Prevention of Measles. Crown 8vo, 5*s*.

CARPENTER, W. B.—**The Principles of Mental Physiology.** With their Applications to the Training and Discipline of the Mind, and the Study of its Morbid Conditions. Illustrated. Sixth Edition. 8vo, 12*s*.

Nature and Man. With a Memorial Sketch by the Rev. J. ESTLIN CARPENTER. Portrait. Large crown 8vo, 8*s*. 6*d*.

COTTA, B. von.—**Geology and History.** A Popular Exposition of all that is known of the Earth and its Inhabitants in Pre-historic Times. 12mo, 2*s*.

DANA, James D.—**A Text-Book of Geology,** designed for Schools and Academies. Illustrated. Crown 8vo, 10*s*.

Manual of Geology. Illustrated by a Chart of the World, and over 1000 Figures. 8vo, 21*s*.

DANA, James D.—continued.

The Geological Story Briefly Told. Illustrated. 12mo, 7*s.* 6*d.*

A System of Mineralogy. By J. D. DANA, aided by G. J. BRUSH. Fifth Edition. Royal 8vo, £2 2*s.*

Manual of Mineralogy and Petrography. Fourth Edition. Numerous Woodcuts. Crown 8vo, 8*s.* 6*d.*

DANA, E. S.—**A Text-Book of Mineralogy.** With Treatise on Crystallography and Physical Mineralogy. Third Edition. 800 Woodcuts and 1 Coloured Plate. 8vo, 15*s.*

DU MONCEL, Count.—**The Telephone, the Microphone, and the Phonograph.** With 74 Illustrations. Third Edition. Small crown 8vo, 5*s.*

DYMOCK, W.—**The Vegetable Materia Medica of Western India.** 4 Parts. 8vo, 5*s.* each.

FEATHERMAN, A.—**The Social History of the Races of Mankind.** Demy 8vo. Div. I. The Nigritians. £1 11*s.* 6*d.* Div. II.-I. Papuo and Malayo Melanesians. £1 5*s.* Div. II.-II. Oceano-Melanesians. £1 5*s.* Div. III.-I. Aoneo-Maranonians. 25*s.* Div. III.-II. Chiapo and Guazano Maranonians. 28*s.* Div. V. The Aramæans. £1 1*s.*

FITZGERALD, R. D.—**Australian Orchids.** Folio. Part I. 7 Plates. Part II. 10 Plates. Part III. 10 Plates. Part IV. 10 Plates. Part V. 10 Plates. Part VI. 10 Plates. Each Part, coloured, 21*s.*; plain, 10*s.* 6*d.* Part VII. 10 Plates. Vol. II., Part I. 10 Plates. Each, coloured, 25*s.*

GALLOWAY, Robert.—**A Treatise on Fuel.** Scientific and Practical. With Illustrations. Post 8vo, 6*s.*

Education: Scientific and Technical; or, How the Inductive Sciences are Taught, and How they Ought to be Taught. 8vo, 10*s.* 6*d.*

HAECKEL, Prof. Ernst.—**The History of Creation.** Translation revised by Professor E. RAY LANKESTER, M.A., F.R.S. With Coloured Plates and Genealogical Trees of the various groups of both Plants and Animals. 2 vols. Third Edition. Post 8vo, 32*s.*

The History of the Evolution of Man. With numerous Illustrations. 2 vols. Post 8vo, 32*s.*

A Visit to Ceylon. Post 8vo, 7*s.* 6*d.*

Freedom in Science and Teaching. With a Prefatory Note by T. H. HUXLEY, F.R.S. Crown 8vo, 5*s.*

HEIDENHAIN, Rudolph, M.D.—**Hypnotism, or Animal Magnetism.** With Preface by G. J. ROMANES. Second Edition. Small crown 8vo, 2*s.* 6*d.*

HENWOOD, William Jory.—**The Metalliferous Deposits of Cornwall and Devon.** With Appendices on Subterranean Temperature; the Electricity of Rocks and Veins; the Quantities of Water in the Cornish Mines; and Mining Statistics. With 113 Tables, and 12 Plates, half-bound. 8vo, £2 2*s.*

Observations on Metalliferous Deposits, and on Subterranean Temperature. In 2 Parts. With 38 Tables, 31 Engravings on Wood, and 6 Plates. 8vo, £1 16*s.*

HOSPITALIER, E.—**The Modern Applications of Electricity.** Translated and Enlarged by JULIUS MAIER, Ph.D. 2 vols. Second Edition, Revised, with many additions and numerous Illustrations. Demy 8vo, 25*s.*

HULME, F. Edward.—**Mathematical Drawing Instruments, and How to Use Them.** With Illustrations. Third Edition. Imperial 16mo, 3*s.* 6*d.*

INMAN, James.—**Nautical Tables.** Designed for the Use of British Seamen. New Edition, Revised and Enlarged. Demy 8vo, 16*s.*

KINAHAN, G. H.—**Valleys and their Relation to Fissures, Fractures, and Faults.** Crown 8vo, 7*s.* 6*d.*

KLEIN, Felix.—**Lectures on the Ikosahedron,** and the Solution of Equations of the Fifth Degree. Translated by G. G. MORRICE. Demy 8vo, 10*s.* 6*d.*

LENDENFELD, R. von.—**Monograph of the Horny Sponges.** With 50 Plates. Issued by direction of the Royal Society. 4to, £3.

LESLEY, J. P.—**Man's Origin and Destiny.** Sketched from the Platform of the Physical Sciences. Second Edition. Crown 8vo, 7*s.* 6*d.*

LIVERSIDGE, A.—**The Minerals of New South Wales, etc.** With large Coloured Map. Royal 8vo, 18*s.*

MIVART, St. George.—**On Truth.** Demy 8vo, 16*s.*

The Origin of Human Reason. Demy 8vo, 10*s.* 6*d.*

NICOLS, Arthur, F.G.S., F.R.G.S.—**Chapters from the Physical History of the Earth.** An Introduction to Geology and Palæontology. With numerous Illustrations. Crown 8vo, 5*s.*

PYE, Walter.—**Surgical Handicraft.** A Manual of Surgical Manipulations. With 233 Illustrations on Wood. Second Edition. Crown 8vo, 10*s.* 6*d.*

Elementary Bandaging and Surgical Dressing. For the Use of Dressers and Nurses. 18mo, 2*s.*

RAMSAY, E. P.—**Tabular List of all the Australian Birds at present known to the Author.** Crown 4to, 12*s.* 6*d.*

RIBOT, Prof. Th.—**Heredity:** A Psychological Study of its Phenomena, its Laws, its Causes, and its Consequences. Second Edition. Large crown 8vo, 9*s.*

English Psychology. Crown 8vo, 7*s.* 6*d.*

RODD, Edward Hearle.—**The Birds of Cornwall and the Scilly Islands.** Edited by J. E. HARTING. With Portrait and Map. 8vo, 14*s.*

ROMANES, G. J.—**Mental Evolution in Animals.** With a Posthumous Essay on Instinct by CHARLES DARWIN, F.R.S. Demy 8vo, 12*s.*

Mental Evolution in Man: Origin of Human Faculty. Demy 8vo, 14*s.*

ROSS, Lieut.-Colonel W. A.—**Alphabetical Manual of Blowpipe Analysis.** Crown 8vo, 5*s.*

Pyrology, or Fire Chemistry. Small 4to, 36*s.*

SCHWENDLER, Louis.—**Instructions for Testing Telegraph Lines,** and the Technical Arrangements in Offices. 2 vols. Demy 8vo, 21*s.*

SMITH, Hamilton, Jun.—**Hydraulics.** The Flow of Water through Orifices, over Weirs, and through Open Conduits and Pipes. With 17 Plates. Royal 4to, 30*s.*

STRECKER-WISLICENUS.—**Organic Chemistry.** Translated and Edited, with Extensive Additions, by W. R. HODGKINSON, Ph.D., and A. J. GREENAWAY, F.I.C. Second and cheaper Edition. Demy 8vo, 12*s.* 6*d.*

SYMONS, G. J.—**The Eruption of Krakatoa, and Subsequent Phenomena.** Report of the Krakatoa Committee of the Royal Society. Edited by G. J. SYMONS, F.R.S. With 6 Chromolithographs of the Remarkable Sunsets of 1883, and 40 Maps and Diagrams. 4to, £1 10*s.*

WANKLYN, J. A.—**Milk Analysis.** A Practical Treatise on the Examination of Milk and its Derivatives, Cream, Butter, and Cheese. Second Edition. Crown 8vo, 5*s.*

Tea, Coffee, and Cocoa. A Practical Treatise on the Analysis of Tea, Coffee, Cocoa, Chocolate, Maté (Paraguay Tea). Crown 8vo, 5*s.*

WANKLYN, J. A., and COOPER, W. J.—**Bread Analysis.** A Practical Treatise on the Examination of Flour and Bread. Crown 8vo, 5*s.*

WANKLYN, J. A., and CHAPMAN, E. T.—**Water Analysis.** A Treatise on the Examination of Potable Water. Seventh Edition. Entirely rewritten. Crown 8vo, 5*s.*

WRIGHT, G. Frederick, D.D.—**The Ice Age in North America, and its bearing upon the Antiquity of Man.** With Maps and Illustrations. 8vo, 21*s.*

THE INTERNATIONAL SCIENTIFIC SERIES.

I. **Forms of Water in Clouds and Rivers, Ice and Glaciers.** By J. Tyndall, LL.D., F.R.S. With 25 Illustrations. Ninth Edition. 5*s.*

II. **Physics and Politics**; or, Thoughts on the Application of the Principles of "Natural Selection" and "Inheritance" to Political Society. By Walter Bagehot. Eighth Edition. 5*s.*

III. **Foods.** By Edward Smith, M.D., LL.B., F.R.S. With numerous Illustrations. Ninth Edition. 5*s.*

IV. **Mind and Body: the Theories of their Relation.** By Alexander Bain, LL.D. With Four Illustrations. Eighth Edition. 5*s.*

V. **The Study of Sociology.** By Herbert Spencer. Fourteenth Edition. 5*s.*

VI. **The Conservation of Energy.** By Balfour Stewart, M.A., LL.D., F.R.S. With 14 Illustrations. Seventh Edition. 5*s.*

VII. **Animal Locomotion**; or, Walking, Swimming, and Flying. By J. B. Pettigrew, M.D., F.R.S., etc. With 130 Illustrations. Third Edition. 5*s.*

VIII. **Responsibility in Mental Disease.** By Henry Maudsley, M.D. Fourth Edition. 5*s.*

IX. **The New Chemistry.** By Professor J. P. Cooke. With 31 Illustrations. Ninth Edition. 5*s.*

X. **The Science of Law.** By Professor Sheldon Amos. Sixth Edition. 5*s.*

XI. **Animal Mechanism**: a Treatise on Terrestrial and Aerial Locomotion. By Professor E. J. Marey. With 117 Illustrations. Third Edition. 5*s.*

XII. **The Doctrine of Descent and Darwinism.** By Professor Oscar Schmidt. With 26 Illustrations. Seventh Edition. 5*s.*

XIII. **The History of the Conflict between Religion and Science.** By J. W. Draper, M.D., LL.D. Twentieth Edition. 5*s.*

XIV. **Fungi: their Nature, Influences, and Uses.** By M. C. Cooke, M.A., LL.D. Edited by the Rev. M. J. Berkeley, M.A., F.L.S. With numerous Illustrations. Fourth Edition. 5*s.*

. **The Chemistry of Light and Photography.** By Dr. Hermann Vogel. With 100 Illustrations. Fifth Edition. 5*s.*

I. **The Life and Growth of Language.** By Professor William Dwight Whitney. Fifth Edition. 5*s.*

II. **Money and the Mechanism of Exchange.** By W. Stanley Jevons, M.A., F.R.S. Eighth Edition. 5*s.*

III. **The Nature of Light.** With a General Account of Physical Optics. By Dr. Eugene Lommel. With 188 Illustrations and a Table of Spectra in Chromo-lithography. Fifth Edition. 5*s.*

. **Animal Parasites and Messmates.** By P. J. Van Beneden. With 83 Illustrations. Third Edition. 5*s.*

On Fermentation. By Professor Schützenberger. With 28 Illustrations. Fourth Edition. 5*s.*

I. **The Five Senses of Man.** By Professor Bernstein. With 91 Illustrations. Fifth Edition. 5*s.*

II. **The Theory of Sound in its Relation to Music.** By Professor Pietro Blaserna. With numerous Illustrations. Third Edition. 5*s.*

III. **Studies in Spectrum Analysis.** By J. Norman Lockyer, F.R.S. With 6 Photographic Illustrations of Spectra, and numerous engravings on Wood. Fourth Edition. 6*s.* 6*d.*

IV. **A History of the Growth of the Steam Engine.** By Professor R. H. Thurston. With numerous Illustrations. Fourth Edition. 5*s.*

V. **Education as a Science.** By Alexander Bain, LL.D. Seventh Edition. 5*s.*

VI. **The Human Species.** By Professor A. de Quatrefages. Fifth Edition. 5*s.*

VII. **Modern Chromatics.** With Applications to Art and Industry. By Ogden N. Rood. With 130 original Illustrations. Second Edition. 5*s.*

VIII. **The Crayfish:** an Introduction to the Study of Zoology. By Professor T. H. Huxley. With 82 Illustrations. Fifth Edition, 5*s.*

IX. **The Brain as an Organ of Mind.** By H. Charlton Bastian, M.D. With numerous Illustrations. Third Edition. 5*s.*

X. **The Atomic Theory.** By Professor Wurtz. Translated by E. Cleminshaw, F.C.S. Fifth Edition. 5*s.*

XI. **The Natural Conditions of Existence as they affect Animal Life.** By Karl Semper. With 2 Maps and 106 Woodcuts. Third Edition. 5*s.*

XII. **General Physiology of Muscles and Nerves.** By Professor J. Rosenthal. Third Edition. With 75 Illustrations. 5*s.*

XXXIII. **Sight:** an Exposition of the Principles of Monocular and Binocular Vision. By Joseph le Conte, LL.D. Second Edition. With 132 Illustrations. 5*s*.

XXXIV. **Illusions:** a Psychological Study. By James Sully. Third Edition. 5*s*.

XXXV. **Volcanoes: what they are and what they teach.** By Professor J. W. Judd, F.R.S. With 96 Illustrations on Wood. Fourth Edition. 5*s*.

XXXVI. **Suicide:** an Essay on Comparative Moral Statistics. By Professor H. Morselli. Second Edition. With Diagrams. 5*s*.

XXXVII. **The Brain and its Functions.** By J. Luys. With Illustrations. Second Edition. 5*s*.

XXXVIII. **Myth and Science:** an Essay. By Tito Vignoli. Third Edition. With Supplementary Note. 5*s*.

XXXIX. **The Sun.** By Professor Young. With Illustrations. Third Edition. 5*s*.

XL. **Ants, Bees, and Wasps:** a Record of Observations on the Habits of the Social Hymenoptera. By Sir John Lubbock, Bart., M.P. With 5 Chromo-lithographic Illustrations. Ninth Edition. 5*s*.

XLI. **Animal Intelligence.** By G. J. Romanes, LL.D., F.R.S. Fourth Edition. 5*s*.

XLII. **The Concepts and Theories of Modern Physics.** By J. B. Stallo. Third Edition. 5*s*.

XLIII. **Diseases of Memory:** an Essay in the Positive Psychology. By Professor Th. Ribot. Third Edition. 5*s*.

XLIV. **Man before Metals.** By N. Joly. With 148 Illustrations. Fourth Edition. 5*s*.

XLV. **The Science of Politics.** By Professor Sheldon Amos. Third Edition. 5*s*.

XLVI. **Elementary Meteorology.** By Robert H. Scott. Fourth Edition. With numerous Illustrations. 5*s*.

XLVII. **The Organs of Speech and their Application in the Formation of Articulate Sounds.** By Georg Hermann Von Meyer. With 47 Woodcuts. 5*s*.

XLVIII. **Fallacies.** A View of Logic from the Practical Side. By Alfred Sidgwick. Second Edition. 5*s*.

XLIX. **Origin of Cultivated Plants.** By Alphonse de Candolle. Second Edition. 5*s*.

L. **Jelly-Fish, Star-Fish, and Sea-Urchins.** Being a Research on Primitive Nervous Systems. By G. J. Romanes. With Illustrations. 5*s*.

LI. **The Common Sense of the Exact Sciences.** By the late William Kingdon Clifford. Second Edition. With 100 Figures. 5*s*.

LII. **Physical Expression: Its Modes and Principles.** By Francis Warner, M.D., F.R.C.P., Hunterian Professor of Comparative Anatomy and Physiology, R.C.S.E. With 50 Illustrations. 5*s*.

LIII. **Anthropoid Apes.** By Robert Hartmann. With 63 Illustrations. 5*s*.

LIV. **The Mammalia in their Relation to Primeval Times.** By Oscar Schmidt. With 51 Woodcuts. 5*s*.

LV. **Comparative Literature.** By H. Macaulay Posnett, LL.D. 5*s*.

LVI. **Earthquakes and other Earth Movements.** By Professor John Milne. With 38 Figures. Second Edition. 5*s*.

LVII. **Microbes, Ferments, and Moulds.** By E. L. Trouessart. With 107 Illustrations. 5*s*.

LVIII. **Geographical and Geological Distribution of Animals.** By Professor A. Heilprin. With Frontispiece. 5*s*.

LIX. **Weather.** A Popular Exposition of the Nature of Weather Changes from Day to Day. By the Hon. Ralph Abercromby. Second Edition. With 96 Illustrations. 5*s*.

LX. **Animal Magnetism.** By Alfred Binet and Charles Féré. Second Edition. 5*s*.

LXI. **Manual of British Discomycetes,** with descriptions of all the Species of Fungi hitherto found in Britain included in the Family, and Illustrations of the Genera. By William Phillips, F.L.S. 5*s*.

LXII. **International Law.** With Materials for a Code of International Law. By Professor Leone Levi. 5*s*.

LXIII. **The Geological History of Plants.** By Sir J. William Dawson. With 80 Figures. 5*s*.

LXIV. **The Origin of Floral Structures through Insect and other Agencies.** By Rev. Professor G. Henslow. With 88 Illustrations. 5*s*.

LXV. **On the Senses, Instincts, and Intelligence of Animals.** With special Reference to Insects. By Sir John Lubbock, Bart., M.P. 100 Illustrations. Second Edition. 5*s*.

LXVI. **The Primitive Family: Its Origin and Development.** By C. N. Starcke. 5*s*.

LXVII. **Physiology of Bodily Exercise.** By Fernand Lagrange, M.D. 5*s*.

LXVIII. **The Colours of Animals: their Meaning and Use, especially considered in the Case of Insects.** By E. B. Poulton, F.R.S. With Coloured Frontispiece and 66 Illustrations in Text. 5*s.*

LXIX. **Introduction to Fresh-Water Algæ.** With an Enumeration of all the British Species. By M. C. Cooke. 13 Plates. 5*s.*

ORIENTAL, EGYPTIAN, ETC.

AHLWARDT, W.—**The Divans of the Six Ancient Arabic Poets, Ennābiga, 'Antara, Tharafa, Zuhair, 'Alquama, and Imruulquais.** Edited by W. AHLWARDT. Demy 8vo, 12*s.*

ALABASTER, Henry.—**The Wheel of the Law:** Buddhism illustrated from Siamese Sources. Demy 8vo, 14*s.*

ALI, Moulavi Cherágh.—**The Proposed Political, Legal, and Social Reforms in the Ottoman Empire and other Mohammedan States.** Demy 8vo, 8*s.*

ARNOLD, Sir Edwin, C.S.I.—**With Sa'di in the Garden**; or, The Book of Love. Being the "Ishk," or Third Chapter of the "Bostân" of the Persian Poet Sa'di. Embodied in a Dialogue held in the Garden of the Taj Mahal, at Agra. Crown 8vo, 7*s.* 6*d.*

Lotus and Jewel. Containing "In an Indian Temple," "A Casket of Gems," "A Queen's Revenge," with Other Poems. Second Edition. Crown 8vo, 7*s.* 6*d.*

Death—and Afterwards. Reprinted from the *Fortnightly Review* of August, 1885. With a Supplement. Ninth Edition. Crown 8vo, 1*s.* 6*d.*; paper, 1*s.*

India Revisited. With 32 Full-page Illustrations. From Photographs selected by the Author. Crown 8vo, 7*s.* 6*d.*

The Light of Asia; or, The Great Renunciation. Being the Life and Teaching of Gautama, Prince of India, and Founder of Buddhism. With Illustrations and a Portrait of the Author. Post 8vo, cloth, gilt back and edges; or half-parchment, cloth sides, 3*s.* 6*d.* Library Edition. Crown 8vo, 7*s.* 6*d.* Illustrated Edition. Small 4to, 21*s.*

Indian Poetry. Containing "The Indian Song of Songs," from the Sanskrit of the Gîta Govinda of Jayadeva; Two Books from "The Iliad of India;" and other Oriental Poems. Fifth Edition. 7*s.* 6*d*

ARNOLD, Sir Edwin, C.S.I.—continued.

Pearls of the Faith; or, Islam's Rosary: being the Ninety-nine beautiful names of Allah. With Comments in Verse from various Oriental sources. Fourth Edition. Crown 8vo, 7*s.* 6*d.*

Indian Idylls. From the Sanskrit of the Mahâbhârata. Crown 8vo, 7*s.* 6*d.*

The Secret of Death. Being a Version of the Katha Upanishad, from the Sanskrit. Third Edition. Crown 8vo, 7*s.* 6*d.*

The Song Celestial; or, Bhagavad-Gitâ. Translated from the Sanskrit Text. Second Edition. Crown 8vo, 5*s.*

Poetical Works. Uniform Edition, comprising "The Light of Asia," "Indian Poetry," "Pearls of the Faith," "Indian Idylls," "The Secret of Death," "The Song Celestial," and "With Sa'di in the Garden." In 8 vols. Crown 8vo, cloth, 48*s.*

The Iliad and Odyssey of India. Fcap. 8vo, 1*s.*

A Simple Transliteral Grammar of the Turkish Language. Post 8vo, 2*s.* 6*d.*

Asiatic Society.—Journal of the Royal Asiatic Society of Great Britain and Ireland, from the Commencement to 1863. First Series, complete in 20 vols. 8vo, with many Plates, £10, or in parts from 4*s.* to 6*s.* each.

Journal of the Royal Asiatic Society of Great Britain and Ireland. New Series. 8vo. Stitched in wrapper. 1864–88.

Vol. I., 2 Parts, pp. iv. and 490, 16*s.*—Vol. II., 2 Parts, pp. 522, 16*s.*—Vol. III., 2 Parts, pp. 516, with Photograph, 22*s.*—Vol. IV., 2 Parts, pp. 521, 16*s.*—Vol. V., 2 Parts, pp. 463, with 10 full-page and folding Plates, 18*s.* 6*d.*—Vol. VI., Part 1, pp. 212, with 2 Plates and a Map, 8*s.*—Vol. VI., Part 2, pp. 272, with Plate and a Map, 8*s.*—Vol. VII., Part 1, pp. 194, with a Plate, 8*s.*—Vol. VII., Part 2, pp. 204, with 7 Plates and a Map, 8*s.*—Vol. VIII., Part 1, pp. 156, with 3 Plates and a Plan, 8*s.*—Vol. VIII., Part 2, pp. 152, 8*s.*—Vol. IX., Part 1, pp. 154, with a Plate, 8*s.*—Vol. IX., Part 2, pp. 292, with 3 Plates, 10*s.* 6*d.*—Vol. X., Part 1, pp. 156, with 2 Plates and a Map, 8*s.*—Vol. X., Part 2, pp. 146, 6*s.*—Vol. X., Part 3, pp. 204, 8*s.*—Vol. XI., Part 1, pp. 128, 5*s.*—Vol. XI., Part 2, pp. 158, with 2 Plates, 7*s.* 6*d.*—Vol. XI., Part 3, pp. 250, 8*s.*—Vol. XII., Part 1, pp. 152, 5*s.*—Vol. XII., Part 2, pp. 182, with 2 Plates and a Map, 6*s.*—Vol. XII., Part 3, pp. 100, 4*s.*—Vol. XII., Part 4, pp. x., 152, cxx., 16, 8*s.*—Vol. XIII., Part 1, pp. 120, 5*s.*—Vol. XIII., Part 2, pp. 170, with a Map, 8*s.*—Vol. XIII., Part 3, pp. 178, with a Table, 7*s.* 6*d.*—Vol. XIII., Part 4, pp. 282, with a Plate and Table, 10*s.* 6*d.*—Vol. XIV., Part 1, pp. 124, with a Table and 2 Plates, 5*s.*—Vol. XIV., Part 2, pp. 164, with 1 Table, 7*s.* 6*d.*—Vol. XIV., Part 3, pp. 206, with 6 Plates, 8*s.*—Vol. XIV., Part 4, pp. 492, with 1 Plate, 14*s.*—Vol. XV., Part 1, pp. 136, 6*s.*—Vol. XV., Part 2, pp. 158, with 3 Tables, 5*s.*—Vol. XV., Part 3, pp. 192, 6*s.*—Vol. XV., Part 4, pp.

Asiatic Society—*continued.*

140, 5*s.*—Vol. XVI., Part 1, pp. 138, with 2 Plates, 7*s.*—Vol. XVI., Part 2, pp. 184, with 1 Plate, 9*s.*—Vol. XVI., Part 3, July, 1884, pp. 74-clx., 10*s.* 6*d.*—Vol. XVI., Part 4, pp. 132, 8*s.*—Vol. XVII., Part 1, pp. 144, with 6 Plates, 10*s.* 6*d.*—Vol. XVII., Part 2, pp. 194, with a Map, 9*s.*—Vol. XVII., Part 3, pp. 342, with 3 Plates, 10*s.* 6*d.*—Vol. XVIII., Part 1, pp. 126, with 2 Plates, 5*s.*—Vol. XVIII., Part 2, pp. 196, with 2 Plates, 6*s.*—Vol. XVIII., Part 3, pp. 130, with 11 Plates, 10*s.* 6*d.*—Vol. XVIII., Part 4, pp. 314, with 8 Plates, 7*s.* 6*d.*—Vol. XIX., Part 1, pp. 100, with 3 Plates, 10*s.*—Vol. XIX., Part 2, pp. 156, with 6 Plates, 10*s.*—Vol. XIX., Part 3, pp. 216, with 6 Plates, 10*s.*—Vol. XIX., Part 4, pp. 216, with 1 Plate, 10*s.*—Vol. XX., Part 1, pp. 163, 10*s.*—Vol. XX., Part 2, pp. 155, 10*s.*—Vol. XX., Part 3, pp. 143, with 3 Plates and a Map, 10*s.*—Vol. XX., Part 4, pp. 318, 10*s.*

ASTON, W. G.—**A Short Grammar of the Japanese Spoken Language.** Fourth Edition. Crown 8vo, 12*s.*

A Grammar of the Japanese Written Language. Second Edition. 8vo, 28*s.*

Auctores Sanscriti :—

Vol. I. **The Jaiminîya-Nyâya-Mâlâ-Vistara.** Edited under the supervision of THEODOR GOLDSTÜCKER. Large 4to, £3 13*s.* 6*d.*

Vol. II. **The Institutes of Gautama.** Edited, with an Index of Words, by A. F. STENZLER, Ph.D., Prof. of Oriental Languages in the University of Breslau. 8vo, cloth, 4*s.* 6*d.* ; stitched, 3*s.* 6*d.*

Vol. III. **Vaitâna Sutra : The Ritual of the Atharva Veda.** Edited, with Critical Notes and Indices, by Dr. R. GARBE. 8vo, 5*s.*

Vols. IV. and V. **Vardhamana's Ganaratnamahodadhi,** with the Author's Commentary. Edited, with Critical Notes and Indices, by JULIUS EGGELING. Part I. 8vo, 6*s.* Part II. 8vo, 6*s.*

BABA, Tatui.—**An Elementary Grammar of the Japanese Language.** With Easy Progressive Exercises. Second Edition. Crown 8vo, 5*s.*

BADGER, George Percy, D.C.L.—**An English-Arabic Lexicon.** In which the equivalent for English Words and Idiomatic Sentences are rendered into literary and colloquial Arabic. Royal 4to, 80*s.*

BALFOUR, F. H.—**The Divine Classic of Nan-Hua.** Being the Works of Chuang Tsze, Taoist Philosopher. 8vo, 14*s.*

Taoist Texts, Ethical, Political, and Speculative. Imperial 8vo, 10*s.* 6*d.*

Leaves from my Chinese Scrap-Book. Post 8vo, 7*s.* 6*d.*

BALLANTYNE, J. R.—**Elements of Hindi and Braj Bhakha Grammar.** Compiled for the use of the East India College at Haileybury. Second Edition. Crown 8vo, 5*s.*

First Lessons in Sanskrit Grammar; together with an Introduction to the Hitopadeśa. Fourth Edition. 8vo, 3*s.* 6*d.*

BEAL, S.—**A Catena of Buddhist Scriptures from the Chinese.** 8vo, 15*s.*

The Romantic Legend of Sakya Buddha. From the Chinese-Sanskrit. Crown 8vo, 12*s.*

Buddhist Literature in China. Four Lectures. Demy 8vo, 10*s.* 6*d.*

BEAMES, John.—**Outlines of Indian Philology.** With a Map showing the Distribution of Indian Languages. Second enlarged Edition. Crown 8vo, 5*s.*

A Comparative Grammar of the Modern Aryan Languages of India: Hindi, Panjabi, Sindhi, Gujarati, Marathi, Oriya, and Bengali. 3 vols. 16*s.* each.

BELLEW, Deputy-Surgeon-General H. W.—**The History of Cholera in India from 1862 to 1881.** With Maps and Diagrams. Demy 8vo, £2 2*s.*

A Short Practical Treatise on the Nature, Causes, and Treatment of Cholera. Demy 8vo, 7*s.* 6*d.*

From the Indus to the Tigris. A Narrative of a Journey through Balochistan, Afghanistan, Khorassan, and Iran, in 1872. 8vo, 10*s.* 6*d.*

Kashmir and Kashghar. A Narrative of the Journey of the Embassy to Kashghar in 1873–74. Demy 8vo, 10*s.* 6*d.*

The Races of Afghanistan. Being a Brief Account of the Principal Nations inhabiting that Country. 8vo, 7*s.* 6*d.*

BELLOWS, John.—**English Outline Vocabulary, for the Use of Students of the Chinese, Japanese, and other Languages.** Crown 8vo, 6*s.*

BENFEY, Theodor.—**A Practical Grammar of the Sanskrit Language, for the Use of Early Students.** Second Edition. Royal 8vo, 10*s.* 6*d.*

BENTLEY, W. Holman.—**Dictionary and Grammar of the Kongo Language,** as spoken at San Salvador, the Ancient Capital of the Old Kongo Empire, West Africa. Demy 8vo, 21*s.*

BEVERIDGE, H.—**The District of Bakarganj:** Its History and Statistics. 8vo, 21*s.*

Buddhist Catechism (A); or, Outline of the Doctrine of the Buddha Gotama. By SUBHADRA BHIKSHU. 12mo, 2*s.*

BUDGE, Ernest A.—**Archaic Classics.** Assyrian Texts; being Extracts from the Annals of Shalmaneser II., Sennacherib, and Assur-Bani-Pal. With Philological Notes. Small 4to, 7*s.* 6*d.*

BURGESS, James.—ARCHÆOLOGICAL SURVEY OF WESTERN INDIA:—

Reports—

The Belgâm and Kaladi Districts. With 56 Photographs and Lithographic Plates. Royal 4to, half-bound, £2 2*s.*

The Antiquities of Kâthiâwâd and Kachh. Royal 4to, with 74 Plates. Half-bound, £3 3*s.*

The Antiquities in the Bidar and Aurangabad Districts, in the Territories of His Highness the Nizam of Haiderabad. With 63 Photographic Plates. Royal 4to, half-bound, £2 2*s.*

The Buddhist Cave-Temples and their Inscriptions. Containing Views, Plans, Sections, and Elevation of Façades of Cave-Temples; Drawings of Architectural and Mythological Sculptures; Facsimiles of Inscriptions, etc.; with Descriptive and Explanatory Text, and Translations of Inscriptions. With 86 Plates and Woodcuts. Royal 4to, half-bound, £3 3*s.*

Elura Cave-Temples, and the Brahmanical and Jaina Caves in Western India. With 66 Plates and Woodcuts. Royal 4to, half-bound, £3 3*s.*

ARCHÆOLOGICAL SURVEY OF SOUTHERN INDIA:—

Reports of the Amaravati and Jaggaypyaeta Buddhist Stupas. Containing numerous Collotype and other Illustrations of Buddhist Sculpture and Architecture, etc., in South-Eastern India; Facsimiles of Inscriptions, etc.; with Descriptive and Explanatory Text. Together with Transcriptions, Translations, and Elucidations of the Dhauli and Jaugada Inscriptions of Asoka, by Professor G. BUHLER, LL.D. Vol. I. With numerous Plates and Woodcuts. Royal 4to, half-bound, £4 4*s.*

BURGESS, James.—**Epigraphia Indica and Record of the Archæological Survey of India.** Edited by JAS. BURGESS, LL.D. Parts I., II., and III. Royal 4to, wrappers, 7*s.* each.

BURNELL, A. C.—**Elements of South Indian Palæography,** from the Fourth to the Seventeenth Century A.D. Being an Introduction to the Study of South Indian Inscriptions and MSS. Second enlarged and improved Edition. Map and 35 Plates. 4to, £2 12*s.* 6*d.*

A Classified Index to the Sanskrit MSS. in the Palace at Tanjore. Prepared for the Madras Government. 3 Parts. 4to, 10*s.* each.

CALDWELL, Bishop R.—**A Comparative Grammar of the Dravidian or South Indian Family of Languages.** A second, corrected, and enlarged Edition. Demy 8vo, 28*s*.

CAPPELLER, Carl.—**A Sanskrit-English Dictionary.** Based upon the St. Petersburg Lexicons. Royal 8vo. [*In preparation.*

CHALMERS, J.—**Structure of Chinese Characters,** under 300 Primary Forms, after the Shwoh-wan, 100 A.D. Demy 8vo, 12*s*. 6*d*.

CHAMBERLAIN, B. H.—**A Romanised Japanese Reader.** Consisting of Japanese Anecdotes, Maxims, with English Translation and Notes. 12mo, 6*s*.

The Classical Poetry of the Japanese. Post 8vo, 7*s*. 6*d*.

Handbook of Colloquial Japanese. 8vo, 12*s*. 6*d*.

CHATTERJI, Mohini M.—**The Bhagavad Gîtâ;** or, The Lord's Lay. With Commentary and Notes. Translated from the Sanskrit. Second Edition. Royal 8vo, 10*s*. 6*d*.

CHILDERS, R. C.—**A Pali-English Dictionary,** with Sanskrit Equivalents. Imperial 8vo, £3 3*s*.

The Mahaparinibbanasutta of the Sutta Pitaka. The Pali Text. Edited by R. C. CHILDERS. 8vo, 5*s*.

CHINTAMON, H.—**A Commentary on the Text of the Bhagavad-Gítá;** or, The Discourse between Khrishna and Arjuna of Divine Matters. Post 8vo, 6*s*.

COOMARA SWAMY, Mutu.—**The Dathavansa;** or, The History of the Tooth Relic of Gotama Buddha, in Pali Verse. Edited by MUTU COOMARA SWAMY. Demy 8vo, 10*s*. 6*d*. English Translation. With Notes. 6*s*.

Sutta Nipata; or, Dialogues and Discourses of Gotama Buddha. Translated from the original Pali. Crown 8vo, 6*s*.

COWELL, E. B.—**A Short Introduction to the Ordinary Prakrit of the Sanskrit Dramas.** Crown 8vo, 3*s*. 6*d*.

Prakrita-Prakasa; or, The Prakrit Grammar of Vararuchi, with the Commentary (Manorama) of Bhamaha. 8vo, 14*s*.

CRAVEN, T.—**English-Hindustani and Hindustani-English Dictionary.** 18mo, 3*s*. 6*d*.

CUNNINGHAM, Major-General Alexander.—**The Ancient Geography of India.** I. The Buddhist Period, including the Campaigns of Alexander and the Travels of Hwen-Thsang. With 13 Maps. 8vo, £1 8*s*.

Archæological Survey of India, Reports. With numerous Plates. Vols. I. to XXIII. Royal 8vo, 10*s*. and 12*s*. each.
General Index to Vols. I. to XXIII. Royal 8vo, 12*s*.

CUST, R. N.—**Pictures of Indian Life,** Sketched with the Pen from 1852 to 1881. With Maps. Crown 8vo, 7*s.* 6*d.*

DENNYS, N. B.—**The Folk-Lore of China, and its Affinities with that of the Aryan and Semitic Races.** 8vo, 10*s.* 6*d.*

DOUGLAS, R. K.—**Chinese Language and Literature.** Two Lectures. Crown 8vo, 5*s.*

The Life of Jenghiz Khan. Translated from the Chinese. Crown 8vo, 5*s.*

DOWSON, John.—**A Grammar of the Urdū or Hindūstānī Language.** Second Edition. Crown 8vo, 10*s.* 6*d.*

A Hindūstānī Exercise Book. Containing a Series of Passages and Extracts adapted for Translation into Hindūstānī. Crown 8vo, 2*s.* 6*d.*

DUKA, Theodore.—**An Essay on the Brāhūī Grammar.** Demy 8vo, 3*s.* 6*d.*

DUTT, Romesh Chunder.—**A History of Civilization in Ancient India.** Based on Sanscrit Literature. 3 vols. Crown 8vo. Vol. I. Vedic and Epic Ages. 8*s.* Vol. II. Rationalistic Age. 8*s.* Vol. III. [*In preparation.*

EDKINS, Joseph.—**China's Place in Philology.** An Attempt to show that the Languages of Europe and Asia have a common origin. Crown 8vo, 10*s.* 6*d.*

The Evolution of the Chinese Language. As Exemplifying the Origin and Growth of Human Speech. Demy 8vo, 4*s.* 6*d.*

The Evolution of the Hebrew Language. Demy 8vo, 5*s.*

Introduction to the Study of the Chinese Characters. Royal 8vo, 18*s.*

Egypt Exploration Fund :—

The Store-City of Pithom, and the Route of the Exodus. By EDOUARD NAVILLE. Third Edition. With 13 Plates and 2 Maps. Royal 4to, 25*s.*

Tanis. Part I., 1883–84. By W. M. FLINDERS PETRIE. With 19 Plates and Plans. Royal 4to, 25*s.*

Tanis. Part II. Nebesha, Daphnæ (Tahpenes). By W. M. FLINDERS PETRIE and F. LL. GRIFFITH. 64 Plates. Royal 4to, 25*s.*

Naukratis. Part I. By W. M. FLINDERS PETRIE, CECIL SMITH, E. A. GARDNER, and B. V. HEAD. With 45 Plates. Royal 4to, 25*s.*

Naukratis. Part II. By ERNEST A. GARDNER. With an Appendix by F. LL. GRIFFITH. With 24 Plates. Royal 4to, 25*s.*

Goshen. By E. NAVILLE. With 11 Plates. Royal 4to, 25*s.*

EITEL, E. J.—**Buddhism**: Its Historical, Theoretical, and Popular Aspects. Third, Revised Edition. Demy 8vo, 5*s*.

Handbook for the Student of Chinese Buddhism. Second Edition. Crown 8vo, 18*s*.

ELLIOT, Sir H. M.—**Memoirs on the History, Folk-Lore, and Distribution of the Races of the North-Western Provinces of India.** Edited by J. BEAMES. 2 vols. With 3 Coloured Maps. Demy 8vo, £1 16*s*.

The History of India, as told by its own Historians. The Muhammadan Period. Edited from the Posthumous Papers of the late Sir H. M. ELLIOT. Revised and continued by Professor JOHN DOWSON. 8 vols. 8vo, £8 8*s*.

EMERSON, Ellen Russell.—**Indian Myths**; or, Legends, Traditions, and Symbols of the Aborigines of America. Illustrated. Post 8vo, £1 1*s*.

FERGUSSON, T.—**Chinese Researches.** First Part. Chinese Chronology and Cycles. Crown 8vo, 10*s*. 6*d*.

FINN, Alexander.—**Persian for Travellers.** Oblong 32mo, 5*s*.

FRYER, Major G. E.—**The Khyeng People of the Sandoway District, Arakan.** With 2 Plates. 8vo, 3*s*. 6*d*.

Páli Studies. No. I. Analysis, and Páli Text of the Subodhálankara, or Easy Rhetoric, by Sangharakkhita Thera. 8vo, 3*s*. 6*d*.

GHOSE, Loke N.—**The Modern History of the Indian Chiefs, Rajas, etc.** 2 vols. Post 8vo, 21*s*.

GILES, Herbert A.—**Chinese Sketches.** 8vo, 10*s*. 6*d*.

A Dictionary of Colloquial Idioms in the Mandarin Dialect. 4to, 28*s*.

Synoptical Studies in Chinese Character. 8vo, 15*s*.

Chinese without a Teacher. Being a Collection of Easy and Useful Sentences in the Mandarin Dialect. With a Vocabulary. 12mo, 5*s*.

The San Tzu Ching; or, Three Character Classic; and the Ch'Jen Tsu Wen; or, Thousand Character Essay. Metrically translated by HERBERT A. GILES. 12mo, 2*s*. 6*d*.

GOVER, C. E.—**The Folk-Songs of Southern India.** Containing Canarese, Badaga, Coorg, Tamil, Malayalam, and Telugu Songs. The Cural. 8vo, 10*s*. 6*d*.

GRIFFIN, L. H.—**The Rajas of the Punjab.** History of the Principal States in the Punjab, and their Political Relations with the British Government. Royal 8vo, 21*s*.

GRIFFITH, F. L.—**The Inscriptions of Siut and Der Rifeh.** With 21 Plates. 4to, 10*s*.

GRIFFIS, W. E.—**The Mikado's Empire.** Book I. History of Japan, from B.C. 660 to A.D. 1872. Book II. Personal Experiences, Observations, and Studies in Japan, 1870–1874. Second Edition. Illustrated. 8vo, 20*s.*

Japanese Fairy World. Stories from the Wonder-Lore of Japan. With 12 Plates. Square 16mo, 7*s.* 6*d.*

HAFIZ OF SHIRAZ.—**Selections from his Poems.** Translated from the Persian by HERMANN BICKNELL. With Oriental Bordering in gold and colour, and Illustrations by J. R. HERBERT, R.A. Demy 4to, £2 2*s.*

HAGGARD, W. H., and LE STRANGE, G.—**The Vazir of Lankuran.** A Persian Play. Edited, with a Grammatical Introduction, a Translation, Notes, and a Vocabulary, giving the Pronunciation. Crown 8vo, 10*s.* 6*d.*

HALL, John Carey.—**A General View of Chinese Civilization,** and of the Relations of the West with China. From the French of M. PIERRE LAFFITTE. Demy 8vo, 3*s.*

Hebrew Literature Society.—Lists on application.

HEPBURN, J. C.—**A Japanese and English Dictionary.** Second Edition. Imperial 8vo, 18*s.*

A Japanese-English and English-Japanese Dictionary. Abridged by the Author. Square 16mo, 14*s.*

A Japanese-English and English-Japanese Dictionary. Third Edition. Demy 8vo, half-morocco, cloth sides. 30*s.*

HILMY, H.H. Prince Ibrahim.—**The Literature of Egypt and the Soudan.** From the Earliest Times to the Year 1885 inclusive. A Bibliography; comprising Printed Books, Periodical Writings and Papers of Learned Societies, Maps and Charts, Ancient Papyri, Manuscripts, Drawings, etc. 2 vols. Demy 4to, £3 3*s.*

Hindoo Mythology Popularly Treated. An Epitomised Description of the various Heathen Deities illustrated on the Silver Swami Tea Service presented, as a memento of his visit to India, to H.R.H. the Prince of Wales, K.G., by His Highness the Gaekwar of Baroda. Small 4to, 3*s.* 6*d.*

HODGSON, B. H.—**Essays on the Languages, Literature, and Religion of Nèpal and Tibet.** Together with further Papers on the Geography, Ethnology, and Commerce of those Countries. Royal 8vo, 14*s.*

HOPKINS, F. L.—**Elementary Grammar of the Turkish Language.** With a few Easy Exercises. Crown 8vo, 3*s.* 6*d.*

HUNTER, Sir William Wilson.—**The Imperial Gazetteer of India.** New Edition. In 14 vols. With Maps. 1886–87. Half-morocco, £3 3*s*.

The Indian Empire: Its People, History, and Products. Second and Revised Edition, incorporating the general results of the Census of 1881. With Map. Demy 8vo, £1 1*s*.

A Brief History of the Indian People. Fourth Edition. With Map. Crown 8vo, 3*s*. 6*d*.

The Indian Musalmans. Third Edition. 8vo, 10*s*. 6*d*.

Famine Aspects of Bengal Districts. A System of Famine Warnings. Crown 8vo, 7*s*. 6*d*.

A Statistical Account of Bengal. In 20 vols. 8vo, half-morocco, £5.

A Statistical Account of Assam. 2 vols. With 2 Maps. 8vo, half-morocco, 10*s*.

Catalogue of Sanskrit Manuscripts (Buddhist). Collected in Nepal by B. H. Hodgson. 8vo, 2*s*.

India.—Publications of the Geographical Department of the India Office, London. A separate list, also list of all the Government Maps, on application.

India.—Publications of the Geological Survey of India. A separate list on application.

India Office Publications:—

Aden, Statistical Account of. 5*s*.

Baden Powell. Land Revenues, etc., in India. 12*s*.

Do. **Jurisprudence for Forest Officers.** 12*s*.

Beal's Buddhist Tripitaka. 4*s*.

Bombay Code. 21*s*.

Bombay Gazetteer. Vol. II. 14*s*. Vol. VIII. 9*s*. Vol. XIII. (2 parts) 16*s*. Vol. XV. (2 parts) 16*s*.

Do. do. Vols. III. to VII., and X., XI., XII., XIV., XVI. 8*s*. each.

Do. do. Vols. XXI., XXII., and XXIII. 9*s*. each.

Burgess' Archæological Survey of Western India. Vol. II. 63*s*.

Do. do. do. Vol. III. 42*s*.

Do. do. Vols. IV. and V. 126*s*.

Do. do. **Southern India.** Vol. I. 84*s*.

Burma (British) Gazetteer. 2 vols. 50*s*.

India Office Publications—*continued.*

Corpus Inscriptionem Indicarum. Vol. I. 32*s.* Vol. III. 50*s.*

Cunningham's Archæological Survey. Vols. I. to XXIII. 10*s.* and 12*s.* each.

Do. Index to Vols. I. to XXIII. 12*s.*

Finance and Revenue Accounts of the Government of India for 1883-4. 2*s.* 6*d.*

Gamble. Manual of Indian Timbers. 10*s.*

Indian Education Commission, Report of the. 12*s.* Appendices. 10 vols. 10*s.*

Jaschke's Tibetan-English Dictionary. 30*s.*

Liotard's Silk in India. Part I. 2*s.*

Loth. Catalogue of Arabic MSS. 10*s.* 6*d.*

Markham's Abstract of Reports of Surveys. 1*s.* 6*d.*

Mitra (Rajendralala), Buddha Gaya. 60*s.*

Moir. Torrent Regions of the Alps. 1*s.*

Mueller. Select Plants for Extra-Tropical Countries. 8*s.*

Mysore and Coorg Gazetteer. Vols. I. and II. 10*s.* each.
Do. **do.** Vol. III. 5*s.*

N. W. P. Gazetteer. Vols. I. and II. 10*s.* each.
Do. **do.** Vols. III. to XI., XIII. and XIV. 12*s.* each.

Oudh **do.** Vols. I. to III. 10*s.* each.

Rajputana Gazetteer. 3 vols. 15*s.*

Saunders' Mountains and River Basins of India. 3*s.*

Taylor. Indian Marine Surveys. 2*s.* 6*d.*

Trigonometrical Survey, Synopsis of Great. Vols. I. to VI. 10*s.* 6*d.* each.

Trumpp's Adi Granth. 52*s.* 6*d.*

Waring. Pharmacopœia of India (The). 6*s.*

Watson's Tobacco. 5*s.*

Wilson. Madras Army. Vols. I. and II. 21*s.*

International Numismata Orientalia (The). Royal 4to, in paper wrapper. Part I. Ancient Indian Weights. By E. THOMAS, F.R.S. With a Plate and Map of the India of Manu. 9*s.* 6*d.* Part II. Coins of the Urtukí Turkumáns. By STANLEY LANE POOLE. With 6 Plates. 9*s.* Part III. The Coinage of Lydia

International Numismata Orientalia (The)—*continued.*
and Persia, from the Earliest Times to the Fall of the Dynasty of the Achæmenidæ. By BARCLAY V. HEAD. With 3 Autotype Plates. 10*s.* 6*d.* Part IV. The Coins of the Tuluni Dynasty. By EDWARD THOMAS ROGERS. 1 Plate. 5*s.* Part V. The Parthian Coinage. By PERCY GARDNER. 8 Autotype Plates. 18*s.* Part VI. The Ancient Coins and Measures of Ceylon. By T. W. RHYS DAVIDS. 1 Plate. 10*s.*

Vol. I. Containing the first six parts, as specified above. Royal 4to, half-bound, £3 13*s.* 6*d.*

Vol. II. **Coins of the Jews.** Being a History of the Jewish Coinage and Money in the Old and New Testaments. By F. W. MADDEN, M.R.A.S. With 279 Woodcuts and a Plate of Alphabets. Royal 4to, £2.

Vol. III. Part I. **The Coins of Arakan, of Pegu, and of Burma.** By Lieut.-General Sir ARTHUR PHAYRE, C.B. Also contains the Indian Balhara, and the Arabian Intercourse with India in the Ninth and following Centuries. By EDWARD THOMAS, F.R.S. With 5 Autotype Illustrations. Royal 4to, 8*s.* 6*d.*

Vol. III. Part II. **The Coins of Southern India.** By Sir W. ELLIOT. With Map and Plates. Royal 4to, 25*s.*

JÄSCHKE, H. A.—**A Tibetan-English Dictionary.** With special reference to the Prevailing Dialects. To which is added an English-Tibetan Vocabulary. Imperial 8vo, £1 10*s.*

Jataka (The), together with its **Commentary.** Being Tales of the Anterior Birth of Gotama Buddha. Now first published in Pali, by V. FAUSBÖLL. Text. 8vo. Vol. I. 28*s.* Vol. II. 28*s.* Vol. III. 28*s.* Vol. IV. 28*s.* Vol. V., completing the work, is in preparation.

JENNINGS, Hargrave.—**The Indian Religions**; or, Results of the Mysterious Buddhism. Demy 8vo, 10*s.* 6*d.*

JOHNSON, Samuel.—**Oriental Religions and their Relation to Universal Religion.** Persia. Demy 8vo, 18*s.*

KISTNER, Otto.—**Buddha and his Doctrines.** A Bibliographical Essay. 4to, 2*s.* 6*d.*

KNOWLES, J. H.—**Folk-Tales of Kashmir.** Post 8vo, 16*s.*

KOLBE, F. W.—**A Language-Study based on Bantu**; or, An Inquiry into the Laws of Root-Formation. Demy 8vo, 6*s.*

KRAPF, L.—**Dictionary of the Suahili Language.** 8vo, 30*s.*

LEGGE, James.—**The Chinese Classics.** With a Translation, Critical and Exegetical. In 7 vols. Vols. I.-V. in 8 Parts, published. Royal 8vo, £2 2*s.* each part.

LEGGE, James—continued.

* **The Chinese Classics**, translated into English. With Preliminary Essays and Explanatory Notes. Popular Edition. Crown 8vo. Vol. I. Life and Teachings of Confucius. Sixth Edition. 10*s*. 6*d*. Vol. II. Works of Mencius. 12*s*. Vol. III. She-King; or, Book of Poetry. 12*s*.

LILLIE, Arthur, M.R.A.S.—**The Popular Life of Buddha.** Containing an Answer to the Hibbert Lectures of 1881. With Illustrations. Crown 8vo, 6*s*.

Buddhism in Christendom; or, Jesus the Essene. With Illustrations. Demy 8vo, 15*s*.

LOBSCHEID, W.—**Chinese and English Dictionary**, arranged according to the Radicals. Imperial 8vo, £2 8*s*.

English and Chinese Dictionary, with the Punti and Mandarin Pronunciation. Folio, £8 8*s*.

Maha-vira-Charita; or, The Adventures of the Great Hero Rama. An Indian Drama. Translated from the Sanskrit of BHAVABHÜTI. By JOHN PICKFORD. Crown 8vo, 5*s*.

MARIETTE-BEY, Auguste.—**The Monuments of Upper Egypt.** A Translation of the "Itinéraire de la Haute Egypt" of AUGUSTE MARIETTE-BEY. By ALPHONSE MARIETTE. Crown 8vo, 7*s*. 6*d*.

MARSDEN, William.—**Numismata Orientalia Illustrata: The Plates of the Oriental Coins, Ancient and Modern,** of the Collection of the late WILLIAM MARSDEN, F.R.S. Engraved from Drawings made under his Directions. 57 Plates. 4to, 31*s*. 6*d*.

MASON, F.—**Burma: Its People and Productions**; or, Notes on the Fauna, Flora, and Minerals of Tenasserim, Pegu, and Burma. Vol. I. Geology, Mineralogy, and Zoology. Vol. II. Botany. Rewritten by W. THEOBALD. 2 vols. Royal 8vo, £3.

MAXWELL, W. E.—**A Manual of the Malay Language.** Second Edition. Crown 8vo, 7*s*. 6*d*.

MAYERS, Wm. Fred.—**The Chinese Government.** A Manual of Chinese Titles. Second Edition. Royal 8vo, 15*s*.

Megha-Duta (The). (Cloud Messenger.) By KĀLIDĀSA. Translated from the Sanskrit into English Verse by the late H. H. WILSON, F.R.S. The Vocabulary by FRANCIS JOHNSON. New Edition. 4to, 10*s*. 6*d*.

MOCKLER, E.—**A Grammar of the Baloochee Language,** as it is spoken in Makran (Ancient Gedrosia), in the Persia-Arabic and Roman characters. Fcap. 8vo, 5*s*.

MUIR, John.—**Original Sanskrit Texts,** on the Origin and History of the People of India. Translated by JOHN MUIR, LL.D.

UIR, John—continued.

Vol. I. Mythical and Legendary Accounts of the Origin of Caste, with an Inquiry into its Existence in the Vedic Age. Third Edition. 8vo, £1 1*s*.

Vol. II. The Trans-Himalayan Origin of the Hindus, and their Affinity with the Western Branches of the Aryan Race. Second Edition. 8vo, £1 1*s*.

Vol. III. The Vedas: Opinions of their Authors, and of later Indian Writers, on their Origin, Inspiration, and Authority. Second Edition. 8vo, 16*s*.

Vol. IV. Comparison of the Vedic with the Later Representation of the Principal Indian Deities. Second Edition. 8vo, £1 1*s*.

Vol. V. Contributions to a Knowledge of the Cosmogony, Mythology, Religious Ideas, Life and Manners of the Indians in the Vedic Age. Third Edition. 8vo, £1 1*s*.

ÜLLER, F. Max.—**Outline Dictionary,** for the Use of Missionaries, Explorers, and Students of Language. 12mo, morocco, 7*s*. 6*d*.

The Sacred Hymns of the Brahmins, as preserved in the Oldest Collection of Religious Poetry, the Rig-Veda-Sanhita. Translated by F. MAX MÜLLER. Vol. I. Hymns to the Maruts, or the Storm-Gods. 8vo, 12*s*. 6*d*.

The Hymns of the Rig-Veda, in the Samhita and Pada Texts. 2 vols. Second Edition. 8vo, £1 12*s*.

ágánanda; or, The Joy of the Snake World. A Buddhist Drama. Translated from the Sanskrit of Sri-Harsha-Deva, with Notes. By P. BOYD. Crown 8vo, 4*s*. 6*d*.

EWMAN, Francis William.—**A Handbook of Modern Arabic.** Post 8vo, 6*s*.

A Dictionary of Modern Arabic. Anglo-Arabic Dictionary and Arabo-English Dictionary. 2 vols. Crown 8vo, £1 1*s*.

riental Text Society's Publications. A list may be had on application.

ALMER, the late E. H.—**A Concise English-Persian Dictionary.** With a Simplified Grammar of the Persian Language. Royal 16mo, 10*s*. 6*d*.

A Concise Persian-English Dictionary. Second Edition. Royal 16mo, 10*s*. 6*d*.

RATT, George.—**A Grammar and Dictionary of the Samoan Language.** Second Edition. Crown 8vo, 18*s*.

EDHOUSE, J. W.—**The Turkish Vade-Mecum of Ottoman Colloquial Language.** English and Turkish, and Turkish and English. The whole in English Characters, the Pronunciation being fully indicated. Third Edition. 32mo, 6*s*.

REDHOUSE, J. W.—continued.

On the History, System, and Varieties of Turkish Poetry. Illustrated by Selections in the Original and in English Paraphrase. 8vo, 2*s.* 6*d.*; wrapper, 1*s.* 6*d.*

A Tentative Chronological Synopsis of the History of Arabia and its Neighbours, from B.C. 500,000 (?) to A.D. 679. Demy 8vo, 1*s.*

Rig-Veda-Sanhita. A Collection of Ancient Hindu Hymns. Translated from the Sanskrit by the late H. H. WILSON, F.R.S. Edited by E. B. COWELL and W. F. WEBSTER. In 6 vols. 8vo, cloth. Vols. I., II., III. 21*s.* each. Vol. IV. 14*s.* Vols. V. and VI. 21*s.* each.

SACHAU, Edward.—**Albêrûnî's India.** An Account of the Religion, Philosophy, Literature, Geography, Chronology, Astronomy, Customs, Laws, and Astrology of India, about A.D. 1030. Edited in the Arabic Original by Dr. EDWARD SACHAU. 4to, £3 3*s.*

An English Edition. With Notes and Indices. 2 vols. Post 8vo, 36*s.*

SALMONÉ, H. A.—**An Arabic-English Dictionary.** Comprising about 120,000 Arabic Words, with an English Index of about 50,000 Words. 2 vols. Post 8vo, 36*s.*

SATOW, Ernest Mason.—**An English-Japanese Dictionary of the Spoken Language.** Second Edition. Imperial 32mo, 12*s.* 6*d.*

SCHLAGINTWEIT, Emil.—**Buddhism in Tibet.** Illustrated by Literary Documents and Objects of Religious Worship. With a Folio Atlas of 20 Plates, and 20 Tables of Native Print in the Text. Royal 8vo, £2 2*s.*

SCOTT, James George.—**Burma as it was, as it is, and as it will be.** Cheap Edition. Crown 8vo, 2*s.* 6*d.*

SHERRING, M. A.—**The Sacred City of the Hindus.** An Account of Benares in Ancient and Modern Times. With Illustrations. 8vo, 21*s.*

STEELE, Th.—**An Eastern Love-Story.** Kusa Játakaya. Crown 8vo, 6*s.*

SUYEMATZ, K.—**Genji Monogatari.** The Most Celebrated of the Classical Japanese Romances. Translated by K. SUYEMATZ. Crown 8vo, 7*s.* 6*d.*

TARRING, C. J.—**A Practical Elementary Turkish Grammar.** Crown 8vo, 6*s.*

Vazir of Lankuran. A Persian Play. A Text-Book of Modern Colloquial Persian. Edited by W. H. HAGGARD and G. LE STRANGE. Crown 8vo, 10*s.* 6*d.*

WATSON, John Forbes.—**Index to the Native and Scientific Names of Indian and other Eastern Economic Plants and Products.** Imperial 8vo, £1 11*s.* 6*d.*

WHEELER, J. Talboys.—**The History of India from the Earliest Ages.** Demy 8vo. Vol. I. Containing the Vedic Period and the Mahá Bhárata. With Map. Vol. II. The Ramayana, and the Brahmanic Period. With 2 Maps. 21*s.* Vol. III. Hindu, Buddhist, Brahmanical Revival. With 2 Maps. 8vo, 18*s.* This volume may be had as a complete work with the following title, "History of India: Hindu, Buddhist, and Brahmanical." Vol. IV. Part I. Mussulman Rule. 14*s.* Vol. IV. Part II. Completing the History of India down to the time of the Moghul Empire. 12*s.*

Early Records of British India. A History of the English Settlements in India, as told in the Government Records, and other Contemporary Documents, from the earliest period down to the rise of British Power in India. Royal 8vo, 15*s.*

WHITNEY, W. D.—**A Sanskrit Grammar,** including both the Classical Language and the older Dialects of Veda and Brahmana. Second Edition. 8vo, 12*s.*

WHITWORTH, George Clifford.—**An Anglo-Indian Dictionary:** a Glossary of Indian Terms used in English, and of such English or other Non-Indian Terms as have obtained special meanings in India. Demy 8vo, cloth, 12*s.*

WILLIAMS, S. Wells.—**A Syllabic Dictionary of the Chinese Language;** arranged according to the Wu-Fang Yuen Yin, with the Pronunciation of the Characters as heard in Pekin, Canton, Amoy, and Shanghai. 4to, £5 5*s.*

WILSON.—**Works of the late Horace Hayman Wilson.**

Vols. I. and II. Essays and Lectures chiefly on the Religion of the Hindus. Collected and Edited by Dr. REINHOLD ROST. 2 vols. Demy 8vo, 21*s.*

Vols. III., IV., and V. Essays Analytical, Critical, and Philological, on Subjects connected with Sanskrit Literature. Collected and Edited by Dr. REINHOLD ROST. 3 vols. Demy 8vo, 36*s.*

Vols. VI., VII., VIII., IX., and X. (2 parts). Vishnu Puráná, a System of Hindu Mythology and Tradition. From the original Sanskrit. Illustrated by Notes derived chiefly from other Puránás, Edited by FITZEDWARD HALL, D.C.L. Vols. I. to V. (2 parts). Demy 8vo, £3 4*s.* 6*d.*

Vols. XI. and XII. Select Specimens of the Theatre of the Hindus. From the original Sanskrit. Third Edition. 2 vols. Demy 8vo, 21*s.*

WRIGHT, W.—**The Book of Kalilah and Dimnah.** Translated from Arabic into Syriac. Demy 8vo, 21*s.*

TRUBNER'S ORIENTAL SERIES.

Essays on the Sacred Language, Writings, and Religion of the Parsis. By MARTIN HAUG, Ph.D. Third Edition, Edited and Enlarged by E. W. WEST. 16*s*.

Texts from the Buddhist Canon, commonly known as Dhammapada. Translated from the Chinese by S. BEAL. 7*s*. 6*d*.

The History of Indian Literature. By ALBRECHT WEBER. Translated from the German by J. MANN and Dr. T. ZACHARIAE. Second Edition. 10*s*. 6*d*.

A Sketch of the Modern Languages of the East Indies. With 2 Language Maps. By ROBERT CUST. 7*s*. 6*d*.

The Birth of the War-God. A Poem. By KÁLIDASÁ. Translated from the Sanskrit by RALPH T. H. GRIFFITHS. Second Edition. 5*s*.

A Classical Dictionary of Hindu Mythology and History, Geography and Literature. By JOHN DOWSON. 16*s*.

Metrical Translations from Sanskrit Writers. By J. MUIR. 14*s*.

Modern India and the Indians. Being a Series of Impressions, Notes, and Essays. By Sir MONIER MONIER-WILLIAMS. Fourth Edition. 14*s*.

The Life or Legend of Gaudama, the Buddha of the Burmese. By the Right Rev. P. BIGANDET. Third Edition. 2 vols. 21*s*.

Miscellaneous Essays, relating to Indian Subjects. By B. H. HODGSON. 2 vols. 28*s*.

Selections from the Koran. By EDWARD WILLIAM LANE. A New Edition. With an Introduction by STANLEY LANE POOLE. 9*s*.

Chinese Buddhism. A Volume of Sketches, Historical and Critical. By J. EDKINS, D.D. 18*s*.

The Gulistan; or, Rose Garden of Shekh Mushliu-'d-Din Sadi of Shiraz. Translated from the Atish Kadah, by E. B. EASTWICK, F.R.S. Second Edition. 10*s*. 6*d*.

A Talmudic Miscellany; or, One Thousand and One Extracts from the Talmud, the Midrashim, and the Kabbalah. Compiled and Translated by P. J. HERSHON. 14*s*.

The History of Esarhaddon (Son of Sennacherib), King of Assyria, B.C. 681–668. Translated from the Cuneiform Inscriptions in the British Museum. Together with Original Texts. By E. A. BUDGE. 10*s*. 6*d*.

Buddhist Birth-Stories; or, Jātaka Tales. The Oldest Collection of Folk-Lore extant: being the Jātakatthavannanā. Edited in the original Pali by V. FAUSBÖLL, and translated by T. W. RHYS DAVIDS. Translation. Vol. I. 18*s.*

The Classical Poetry of the Japanese. By BASIL CHAMBERLAIN. 7*s.* 6*d.*

Linguistic and Oriental Essays. By R. CUST, LL.D. First Series, 10*s.* 6*d.*; Second Series, with 6 Maps, 21*s.*

Indian Poetry. Containing "The Indian Song of Songs," from the Sanskrit of the Gîta Govinda of Jayadeva; Two Books from "The Iliad of India" (Mahábhárata); and other Oriental Poems. By Sir EDWIN ARNOLD, K.C.I.E. Third Edition. 7*s.* 6*d.*

The Religions of India. By A. BARTH. Translated by Rev. J. WOOD. Second Edition. 16*s.*

Hindū Philosophy. The Sānkhya Kārikā of Iswara Krishna. An Exposition of the System of Kapila. By JOHN DAVIES. 6*s.*

A Manual of Hindu Pantheism. The Vedantasara. Translated by Major G. A. JACOB. Second Edition. 6*s.*

The Mesnevī (usually known as the Mesnevīyi Sherīf, or Holy Mesnevī) of Mevlānā (Our Lord) Jelālu-'d-Din Muhammed, Er-Rūmī. Book the First. Illustrated by a Selection of Characteristic Anecdotes as collected by their Historian Mevlānā Shemsu-'d-Dīn Ahmed, El Eflākī El Arifī. Translated by J. W. REDHOUSE. £1 1*s.*

Eastern Proverbs and Emblems illustrating Old Truths. By the Rev. J. LONG. 6*s.*

The Quatrains of Omar Khayyám. A New Translation. By E. H. WHINFIELD. 5*s.*

The Quatrains of Omar Khayyám. The Persian Text, with an English Verse Translation. By E. H. WHINFIELD. 10*s.* 6*d.*

The Mind of Mencius; or, Political Economy founded upon Moral Philosophy. A Systematic Digest of the Doctrines of the Chinese Philosopher Mencius. The Original Text Classified and Translated by the Rev. E. FABER. Translated from the German, with Additional Notes, by the Rev. A. B. HUTCHINSON. 10*s.* 6*d.*

Yúsuf and Zulaika. A Poem by JAMI. Translated from the Persian into English Verse by R. T. H. GRIFFITH. 8*s.* 6*d.*

Tsuni-‖Goam, the Supreme Being of the Khoi-Khoi. By THEOPHILUS HAHN. 7*s.* 6*d.*

A Comprehensive Commentary to the Quran. With SALE'S Preliminary Discourse, and Additional Notes. By Rev. E. M. WHERRY. Vols. I., II., and III. 12*s.* 6*d.* each. Vol. IV. 10*s.* 6*d.*

Hindu Philosophy: The Bhagavad Gîtâ; or, The Sacred Lay. A Sanskrit Philosophical Lay. Translated by JOHN DAVIES. 8*s*. 6*d*.

The Sarva-Darsana-Samgraha; or, Review of the Different Systems of Hindu Philosophy. By MADHAVA ACHARYA. Translated by E. B. COWELL and A. E. GOUGH. 10*s*. 6*d*.

Tibetan Tales. Derived from Indian Sources. Translated from the Tibetan of the Kay-Gyur by F. ANTON VON SCHIEFNER. Done into English from the German by W. R. S. RALSTON. 14*s*.

Linguistic Essays. By CARL ABEL. 9*s*.

The Indian Empire: Its History, People, and Products. By Sir WILLIAM WILSON HUNTER, K.C.S.I. 21*s*.

History of the Egyptian Religion. By Dr. C. P. TIELE, Leiden. Translated by J. BALLINGAL. 7*s*. 6*d*.

The Philosophy of the Upanishads. By A. E. GOUGH. 9*s*.

Udanavarga. A Collection of Verses from the Buddhist Canon. Compiled by DHARMATRÂTA. Translated from the Tibetan by W. WOODVILLE ROCKHILL. 9*s*.

A History of Burma, including Burma Proper, Pegu, Taungu, Tenasserim, and Arakan. From the Earliest Time to the End of the First War with British India. By Lieut.-General Sir ARTHUR P. PHAYRE, C.B. 14*s*.

A Sketch of the Modern Languages of Africa. Accompanied by a Language Map. By R. N. CUST. 2 vols. With 31 Autotype Portraits. 18*s*.

Religion in China. Containing a Brief Account of the Three Religions of the Chinese. By JOSEPH EDKINS, D.D. Third Edition. 7*s*. 6*d*.

Outlines of the History of Religion to the Spread of the Universal Religions. By Prof. C. P. TIELE. Translated from the Dutch by J. ESTLIN CARPENTER. Fourth Edition. 7*s*. 6*d*.

Si-Yu-Ki. Buddhist Records of the Western World. Translated from the Chinese of HIUEN TSAING (A.D. 629). By SAMUEL BEAL. 2 vols. With Map. 24*s*.

The Life of the Buddha, and the Early History of his Order. Derived from Tibetan Works in the Bkah-Hgyur and the Bstan-Hgyur. By W. W. ROCKHILL. 10*s*. 6*d*.

The Sankhya Aphorisms of Kapila. With Illustrative Extracts from the Commentaries. Translated by J. R. BALLANTYNE, LL.D. Third Edition. 16*s*.

The Ordinances of Manu. Translated from the Sanskrit. With an Introduction by the late A. C. BURNELL, C.I.E. Edited by EDWARD W. HOPKINS. 12*s*.

The Life and Works of Alexander Csoma De Körös between 1819 and 1842. With a Short Notice of all his Works and Essays, from Original Documents. By T. DUKA, M.D. 9*s.*

Ancient Proverbs and Maxims from Burmese Sources; or, The Niti Literature of Burma. By JAMES GRAY. 6*s.*

Manava-Dharma-Castra. The Code of Manu. Original Sanskrit Text, with Critical Notes. By Prof. J. JOLLY, Ph.D. 10*s.* 6*d.*

Masnavi I Ma'navi. The Spiritual Couplets of Mauláná Jalálu-'d-Dín Muhammad I Rúmí. Translated and Abridged. By E. H. WHINFIELD. 7*s.* 6*d.*

Leaves from my Chinese Scrap-Book. By F. H. BALFOUR. 7*s.* 6*d.*

Miscellaneous Papers relating to Indo-China. Reprinted from "Dalrymple's Oriental Repertory," "Asiatick Researches," and the "Journal of the Asiatic Society of Bengal." 2 vols. 21*s.*

Miscellaneous Essays on Subjects connected with the Malay Peninsula and the Indian Archipelago. From the "Journals" of the Royal Asiatic, Bengal Asiatic, and Royal Geographical Societies; the "Transactions" and "Journal" of the Asiatic Society of Batavia, and the "Malayan Miscellanies." Edited by R. ROST. Second Series. 2 vols. With 5 Plates and a Map. £1 5*s.*

The Satakas of Bhartrihari. Translated from the Sanskrit by the Rev. B. HALE WORTHAM. 5*s.*

Albêrûnî's India. An Account of the Religion of India: its Philosophy, Literature, Geography, Chronology, Astronomy, Customs, Law, and Astrology, about A.D. 1030. By EDWARD SACHAU. 2 vols. 36*s.*

The Folk-Tales of Kashmir. By the Rev. J. HINTON KNOWLES. 16*s.*

Mediæval Researches from Eastern Asiatic Sources. Fragments towards the Knowledge of the Geography and History of Central and Western Asia from the Thirteenth to the Seventeenth Century. By E. BRETSCHNEIDER, M.D. 2 vols. With 2 Maps. 21*s.*

The Life of Hiuen-Tsiang. By the Shamans HWUI LI and YEN-TSUNG. With an Account of the Works of I-Tsing. By Prof. SAMUEL BEAL. 10*s.*

English Intercourse with Siam in the Seventeenth Century. By J. ANDERSON, M.D., LL.D., F.R.S. 15*s.*

Bihar Proverbs. By JOHN CHRISTIAN. [*In preparation.*

Original Sanskrit Texts on the Origin and History of the People of India: Their Religion and Institutions. Collected, Translated, and Illustrated. By J. MUIR, LL.D. Vol. I. Mythical and Legendary Accounts of the Origin of Caste, with an inquiry into its existence in the Vedic Age. Third Edition. 21*s.*

MILITARY WORKS.

BRACKENBURY, Col. C. B., R.A.—**Military Handbooks for Regimental Officers.**

I. **Military Sketching and Reconnaissance.** By Col. F. J. Hutchison and Major H. G. MacGregor. Fifth Edition. With 16 Plates. Small crown 8vo, 4*s.*

II. **The Elements of Modern Tactics Practically applied to English Formations.** By Lieut.-Col. Wilkinson Shaw. Seventh Edition. With 25 Plates and Maps. Small crown 8vo, 9*s.*

III. **Field Artillery.** Its Equipment, Organization and Tactics. By Lieut.-Col. Sisson C. Pratt, R.A. Fourth Edition. Small crown 8vo, 6*s.*

IV. **The Elements of Military Administration.** First Part: Permanent System of Administration. By Major J. W. Buxton. Small crown 8vo, 7*s.* 6*d.*

V. **Military Law: Its Procedure and Practice.** By Lieut.-Col. Sisson C. Pratt, R.A. Fifth Edition. Revised. Small crown 8vo, 4*s.* 6*d.*

VI. **Cavalry in Modern War.** By Major-General F. Chenevix Trench, C.M.G. Small crown 8vo, 6*s.*

VII. **Field Works.** Their Technical Construction and Tactical Application. By the Editor, Col. C. B. Brackenbury, R.A. Small crown 8vo, in 2 parts, 12*s.*

BROOKE, Major, C. K.—**A System of Field Training.** Small crown 8vo, cloth limp, 2*s.*

Campaign of Fredericksburg, November—December, 1862. A Study for Officers of Volunteers. By a Line Officer. With 5 Maps and Plans. Second Edition. Crown 8vo, 5*s.*

CLERY, C. Francis, Col.—**Minor Tactics.** With 26 Maps and Plans. Eighth Edition, Revised. Crown 8vo, 9*s.*

COLVILE, Lieut.-Col. C. F.—**Military Tribunals.** Sewed, 2*s.* 6*d.*

CRAUFURD, Capt. H. J.—**Suggestions for the Military Training of a Company of Infantry.** Crown 8vo, 1*s.* 6*d.*

HAMILTON, Capt. Ian, A.D.C.—**The Fighting of the Future.** 1*s.*

HARRISON, Col. R.—**The Officer's Memorandum Book for Peace and War.** Fourth Edition, Revised throughout. Oblong 32mo, red basil, with pencil, 3*s.* 6*d.*

Notes on Cavalry Tactics, Organisation, etc. By a Cavalry Officer. With Diagrams. Demy 8vo, 12*s.*

PARR, Col. H. Hallam, C.M.G.—**The Dress, Horses, and Equipment of Infantry and Staff Officers.** Crown 8vo, 1*s.*

Further Training and Equipment of Mounted Infantry. Crown 8vo, 1*s.*

PATERSON, Lieut.-Colonel William.—**Notes on Military Surveying and Reconnaissance.** Sixth Edition. With 16 Plates. Demy 8vo, 7*s.* 6*d.*

SCHAW, Col. H.—**The Defence and Attack of Positions and Localities.** Fourth Edition. Crown 8vo, 3*s.* 6*d.*

STONE, Capt. F. Gleadowe, R.A.—**Tactical Studies from the Franco-German War of 1870-71.** With 22 Lithographic Sketches and Maps. Demy 8vo, 10*s.* 6*d.*

WILKINSON, H. Spenser, Capt. 20th Lancashire R.V.—**Citizen Soldiers.** Essays towards the Improvement of the Volunteer Force. Crown 8vo, 2*s.* 6*d.*

EDUCATIONAL.

ABEL, Carl, Ph.D.—**Linguistic Essays.** Post 8vo, 9*s.*

Slavic and Latin. Ilchester Lectures on Comparative Lexicography. Post 8vo, 5*s.*

ABRAHAMS, L. B.—**A Manual of Scripture History for Use in Jewish Schools and Families.** With Map and Appendices. Crown 8vo, 1*s.* 6*d.*

AHN, F.—**A Concise Grammar of the Dutch Language,** with Selections from the best Authors in Prose and Poetry. After Dr. F. Ahn's Method. 12mo, 3*s.* 6*d.*

Practical Grammar of the German Language. Crown 8vo, 3*s.* 6*d.*

AHN, F.—continued.

New, Practical, and Easy Method of Learning the German Language. First and Second Courses in 1 vol. 12mo, 3*s.*

Key to Ditto. 12mo, 8*d.*

Manual of German and English Conversations, or Vade Mecum for English Travellers. 12mo, 1*s.* 6*d.*

New, Practical, and Easy Method of Learning the French Language. First Course and Second Course. 12mo, each 1*s.* 6*d.* The Two Courses in 1 vol. 12mo, 3*s.*

New, Practical, and Easy Method of Learning the French Language. Third Course, containing a French Reader, with Notes and Vocabulary. 12mo, 1*s.* 6*d.*

New, Practical, and Easy Method of Learning the Italian Language. First and Second Courses. 12mo, 3*s.* 6*d.*

Ahn's Course. Latin Grammar for Beginners. By W. IHNE, Ph.D. 12mo, 3*s.*

BARANOWSKI, J. J.—**Anglo-Polish Lexicon.** Fcap. 8vo, 12*s.*

Slownik Polsko-Angielski. (Polish-English Lexicon.) Fcap. 8vo, 12*s.*

BELLOWS, John.—**French and English Dictionary for the Pocket.** Containing the French-English and English-French divisions on the same page; conjugating all the verbs; distinguishing the genders by different types; giving numerous aids to pronunciation; indicating the *liaison* or *non-liaison* of terminal consonants; and translating units of weight, measure, and value by a series of tables. Second Edition. 32mo, roan, 10*s.* 6*d.*; morocco tuck, 12*s.* 6*d.*

Tous les Verbes. Conjugations of all the Verbs in the French and English Languages. 32mo, 6*d.*

BOJESEN, Maria.—**A Guide to the Danish Language.** Designed for English Students. 12mo, 5*s.*

BOLIA, C.—**The German Caligraphist.** Copies for German Handwriting. Oblong 4to, 1*s.*

BOWEN, H. C., M.A.—**Studies in English.** For the use of Modern Schools. Tenth Thousand. Small crown 8vo, 1*s.* 6*d.*

English Grammar for Beginners. Fcap. 8vo, 1*s.*

Simple English Poems. English Literature for Junior Classes. In four parts. Parts I., II., and III., 6*d.* each. Part IV., 1*s.* Complete, 3*s.*

BRETTE, P.H., and THOMAS, F.—**French Examination Papers set at the University of London.** Arranged and Edited by the Rev. P. H. ERNEST BRETTE, B.D., and FERDINAND THOMAS, B.A. Part I. Matriculation, and the General Examination for Women. Crown 8vo, 3*s.* 6*d.*

French Examination Papers set at the University of London. Key to Part I. Edited by the Rev. P. H. E. BRETTE and F. THOMAS. Crown 8vo, 5*s.*

French Examination Papers set at the University of London. Edited by the Rev. P. H. ERNEST BRETTE and FERDINAND THOMAS. Part II. Crown 8vo, 7*s.*

BUTLER, F.—**The Spanish Teacher and Colloquial Phrase Book.** 18mo, half-roan, 2*s.* 6*d.*

BYRNE, James.—**General Principles of the Structure of Language.** 2 vols. Demy 8vo, 36*s.*

The Origin of Greek, Latin, and Gothic Roots. Demy 8vo, 18*s.*

CAMERINI, E.—**L'Eco Italiano.** A Practical Guide to Italian Conversation. With a Vocabulary. 12mo, 4*s.* 6*d.*

CONTOPOULOS, N.—**A Lexicon of Modern Greek-English and English-Modern Greek.** 2 vols. 8vo, 27*s.*

CONWAY, R. Seymour.—**Verner's Law in Italy.** An Essay in the History of the Indo-European Sibilants. Demy 8vo, 5*s.*

The Italic Dialects. I. The Text of the Inscriptions. II. An Italic Lexicon. Edited and arranged by R. SEYMOUR CONWAY. 8vo. [*In preparation.*

DELBRÜCK, B.—**Introduction to the Study of Language.** The History and Methods of Comparative Philology of the Indo-European Languages. 8vo, 5*s.*

D'ORSEY, A. J. D.—**A Practical Grammar of Portuguese and English.** Adapted to Ollendorff's System. Fourth Edition. 12mo, 7*s.*

Colloquial Portuguese; or, The Words and Phrases of Every-day Life. Fourth Edition. Crown 8vo, 3*s.* 6*d.*

DUSAR, P. Friedrich.—**A Grammar of the German Language.** With Exercises. Second Edition. Crown 8vo, 4*s.* 6*d.*

A Grammatical Course of the German Language. Third Edition. Crown 8vo, 3*s.* 6*d.*

Education Library. Edited by Sir PHILIP MAGNUS:—

An Introduction to the History of Educational Theories. By OSCAR BROWNING, M.A. Second Edition. 3*s.* 6*d.*

Education Library—*continued.*

Industrial Education. By Sir PHILIP MAGNUS. 6*s.*

Old Greek Education. By the Rev. Prof. MAHAFFY, M.A. Second Edition. 3*s.* 6*d.*

School Management. Including a general view of the work of Education, Organization, and Discipline. By JOSEPH LANDON. Seventh Edition. 6*s.*

EGER, Gustav.—**Technological Dictionary in the English and German Languages.** Edited by GUSTAV EGER. 2 vols. Royal 8vo, £1 7*s.*

ELLIS, Robert.—**Sources of the Etruscan and Basque Languages.** Demy 8vo, 7*s.* 6*d.*

FRIEDRICH, P.—**Progressive German Reader.** With Copious Notes to the First Part. Crown 8vo, 4*s.* 6*d.*

FRŒMBLING, Friedrich Otto.—**Graduated German Reader.** A Selection from the most Popular Writers; with a Vocabulary for the First Part. Tenth Edition. 12mo, 3*s.* 6*d.*

Graduated Exercises for Translation into German. Consisting of Extracts from the best English Authors; with Idiomatic Notes. Crown 8vo, 4*s.* 6*d.* Without Notes, 4*s.*

GARLANDA, Federico.—**The Fortunes of Words.** Letters to a Lady. Crown 8vo, 5*s.*

The Philosophy of Words. A Popular Introduction to the Science of Language. Crown 8vo, 5*s.*

GELDART, E. M.—**A Guide to Modern Greek.** Post 8vo, 7*s.* 6*d.* Key, 2*s.* 6*d.*

GOWAN, Major Walter E.—**A. Ivanoff's Russian Grammar.** (16th Edition.) Translated, enlarged, and arranged for use of Students of the Russian Language. Demy 8vo, 6*s.*

HODGSON, W. B.—**The Education of Girls; and the Employment of Women of the Upper Classes Educationally considered.** Second Edition. Crown 8vo, 3*s.* 6*d.*

KARCHER, Theodore.—**Questionnaire Francais.** Questions on French Grammar, Idiomatic Difficulties, and Military Expressions. Fourth Edition. Crown 8vo, 4*s.* 6*d.*; interleaved with writing-paper, 5*s.* 6*d.*

LANDON, Joseph.—**School Management;** Including a General View of the Work of Education, Organization, and Discipline. Seventh Edition. Crown 8vo, 6*s.*

LANGE, F. K. W.—**Germania.** A German Reading-Book Arranged Progressively. Part I. Anthology of German Prose and Poetry, with Vocabulary and Biographical Notes. 8vo, 3*s.* 6*d.* Part II. Essays on German History and Institutions, with Notes. 8vo, 3*s.* 6*d.* Parts I. and II. together, 5*s.* 6*d.*

LANGE, F. K. W.—continued.

German Grammar Practice. Crown 8vo, 1*s.* 6*d.*

Colloquial German Grammar. Crown 8vo, 4*s.* 6*d.*

LE-BRUN, L.—**Materials for Translating from English into French.** Seventh Edition. Post 8vo, 4*s.* 6*d.*

Little French Reader (The). Extracted from "The Modern French Reader." Third Edition. Crown 8vo, 2*s.*

MAGNUS, Sir Philip.—**Industrial Education.** Crown 8vo, 6*s.*

MASON, Charlotte M.—**Home Education:** a Course of Lectures to Ladies. Crown 8vo, 3*s.* 6*d.*

MILLHOUSE, John.—**Pronouncing and Explanatory English and Italian Dictionary.** 2 vols. 8vo, 12*s.*

Manual of Italian Conversation. 18mo, 2*s.*

Modern French Reader (The). A Glossary of Idioms, Gallicisms, and other Difficulties contained in the Senior Course of the Modern French Reader. By CHARLES CASSAL. Crown 8vo, 2*s.* 6*d.*

Modern French Reader (The). Prose. Junior Course. Tenth Edition. Edited by CH. CASSAL and THÉODORE KARCHER. Crown 8vo, 2*s.* 6*d.*

Senior Course. Third Edition. Crown 8vo, 4*s.*

Modern French Reader. Senior Course and Glossary combined. 6*s.*

NUGENT.—**Improved French and English and English and French Pocket Dictionary.** 24mo, 3*s.*

OLLENDORFF.—**Metodo para aprender a Leer,** escribir y hablar el Inglés segun el sistema de Ollendorff. Por RAMON PALENZUELA y JUAN DE LA CARREÑO. 8vo, 4*s.* 6*d.* Key to ditto. Crown 8vo, 3*s.*

Metodo para aprender a Leer, escribir y hablar el Frances, segun el verdadero sistema de Ollendorff. Por TEODORO SIMONNÉ. Crown 8vo, 6*s.* Key to ditto. Crown 8vo, 3*s.* 6*d.*

OTTÉ, E. C.—**Dano-Norwegian Grammar.** A Manual for Students of Danish based on the Ollendorffian System. Third Edition. Crown 8vo, 7*s.* 6*d.* Key to above. Crown 8vo, 3*s.*

PONSARD, F.—**Charlotte Corday.** A Tragedy. Edited, with English Notes and Notice on Ponsard, by Professor C. CASSAL, LL.D. Third Edition. 12mo, 2*s.* 6*d.*

L'Honneur et l'Argent. A Comedy. Edited, with English Notes and Memoir of Ponsard, by Professor C. CASSAL, LL.D. Second Edition. 12mo, 3*s.* 6*d.*

RASK, Erasmus.—**Grammar of the Anglo-Saxon Tongue.** from the Danish of ERASMUS RASK. By BENJAMIN THORPE. Third Edition. Post 8vo, 5*s.* 6*d.*

RIOLA, Henry.—**How to Learn Russian.** A Manual for Students, based upon the Ollendorffian System. With Preface by W. R. S. RALSTON. Fourth Edition. Crown 8vo, 12*s.*

Key to the above. Crown 8vo, 5*s.*

A Graduated Russian Reader. With a Vocabulary. Crown 8vo, 10*s.* 6*d.*

ROCHE, A.—**A French Grammar.** Adopted for the Public Schools by the Imperial Council of Public Instruction. Crown 8vo, 3*s.*

Prose and Poetry. Select Pieces from the best English Authors, for Reading, Composition, and Translation. Second Edition. Fcap. 8vo, 2*s.* 6*d.*

ROSING, S.—**English-Danish Dictionary.** Crown 8vo, 8*s.* 6*d.*

SAYCE, A. H.—**An Assyrian Grammar for Comparative Purposes.** Crown 8vo, 7*s.* 6*d.*

The Principles of Comparative Philology. Third Edition. Crown 8vo, 10*s.* 6*d.*

SINCLAIR, F.—**A German Vocabulary.** Crown 8vo, 2*s.*

SMITH, M., and HORNEMAN, H.—**Norwegian Grammar.** With a Glossary for Tourists. Post 8vo, 2*s.*

THOMPSON, A. R.—**Dialogues, Russian and English.** Crown 8vo, 5*s.*

TOSCANI, Giovanni.—**Italian Conversational Course.** Fourth Edition. 12mo, 5*s.*

Italian Reading Course. Fcap. 8vo, 4*s.* 6*d.*

Trübner's Catalogue of Dictionaries and Grammars of the Principal Languages and Dialects of the World. Second Edition. 8vo, 5*s.*

Trübner's Collection of Simplified Grammars of the Principal Asiatic and European Languages. Edited by REINHOLD ROST, LL.D. Crown 8vo.

I. **Hindustani, Persian, and Arabic.** By E. H. PALMER. Second Edition. 5*s.*
II. **Hungarian.** By I. SINGER. 4*s.* 6*d.*
III. **Basque.** By W. VAN EYS. 3*s.* 6*d.*
IV. **Malagasy.** By G. W. PARKER. 5*s.*
V. **Modern Greek.** By E. M. GELDART. 2*s.* 6*d.*
VI. **Roumanian.** By R. TORCEANU. 5*s.*
VII. **Tibetan Grammar.** By H. A. JASCHKE. 5*s.*
VIII. **Danish.** By E. C. OTTÉ. 2*s.* 6*d.*
IX. **Turkish.** By J. W. REDHOUSE. 10*s.* 6*d.*

Trübner's Collection of Simplified Grammars of the Principal Asiatic and European Languages—*continued.*

X. **Swedish.** By E. C. OTTÉ. 2*s.* 6*d.*

XI. **Polish.** By W. R. MORFILL. 3*s.* 6*d.*

XII. **Pali.** By E. MÜLLER. 7*s.* 6*d.*

XIII. **Sanskrit.** By H. EDGREN. 10*s.* 6*d.*

XIV. **Grammaire Albanaise.** Par P. W. 7*s.* 6*d.*

XV. **Japanese.** By B. H. CHAMBERLAIN. 5*s.*

XVI. **Serbian.** By W. R. MORFILL. 4*s.* 6*d.*

XVII. **Cuneiform Inscriptions.** By GEORGE BERTIN, 5*s.*

XVIII. **Panjābī Language.** By the Rev. W. ST. CLAIR TISDALL. 7*s.* 6*d.*

XIX. **Spanish.** By W. F. HARVEY. 3*s.* 6*d.*

VAN LAUN.—**Grammar of the French Language.** Crown 8vo. Parts I. and II. Accidence and Syntax. 4*s.* Part III. Exercises. 3*s.* 6*d.*

VELASQUEZ, M., de la Cadena.—**A Dictionary of the Spanish and English Languages.** For the Use of Young Learners and Travellers. In 2 parts. I. Spanish-English. II. English-Spanish. Crown 8vo, 6*s.*

A Pronouncing Dictionary of the Spanish and English Languages. 2 parts in one volume. Royal 8vo, £1 4*s.*

New Spanish Reader. Passages from the most approved Authors, in Prose and Verse. With Vocabulary. Post 8vo, 6*s.*

An Easy Introduction to Spanish Conversation. 12mo, 2*s.* 6*d.*

VELASQUEZ and SIMONNÉ.—**New Method to Read, Write, and Speak the Spanish Language.** Adapted to Ollendorff's System. Post 8vo, 6*s.* Key. Post 8vo, 4*s.*

VIEYRA.—**A New Pocket Dictionary of the Portuguese and English Languages.** In 2 parts. Portuguese-English and English-Portuguese. 2 vols. Post 8vo, 10*s.*

WELLER, E.—**An Improved Dictionary.** English and French, and French and English. Royal 8vo, 7*s.* 6*d.*

WHITNEY, W. D.—**Language and the Study of Language.** Twelve Lectures on the Principles of Linguistic Science. Fourth Edition. Crown 8vo, 10*s.* 6*d.*

Language and its Study, with especial reference to the Indo-European Family of Languages. Lectures. Edited by the Rev. R. MORRIS, LL.D. Second Edition. Crown 8vo, 5*s.*

WHITNEY, Prof. William Dwight.—**Essentials of English Grammar,** for the Use of Schools. Second Edition. Crown 8vo, 3*s.* 6*d.*

YOUMANS, Eliza A.—**First Book of Botany.** Designed to cultivate the Observing Powers of Children. With 300 Engravings. New and Cheaper Edition. Crown 8vo, 2*s.* 6*d.*

POETRY.

ADAMS, Estelle Davenport.—**Sea Song and River Rhyme, from Chaucer to Tennyson.** With 12 Etchings. Large crown 8vo, 10*s.* 6*d.*

ALEXANDER, William, D.D., Bishop of Derry.—**St. Augustine's Holiday,** and other Poems. Crown 8vo, 6*s.*

ARNOLD, Sir Edwin, C.S.I.—**In my Lady's Praise.** Being Poems Old and New, written to the Honour of Fanny, Lady Arnold. Imperial 16mo, parchment, 3*s.* 6*d.*

Poems: National and Non-Oriental. With some New Pieces. Selected from the Works of Sir EDWIN ARNOLD, C.S.I. Crown 8vo, 7*s.* 6*d.*

⁂ See also under ORIENTAL.

BADDELEY, St. Clair.—**Lotus Leaves.** Fcap. folio, boards, 8*s.* 6*d.*

BARNES, William.—**Poems of Rural Life, in the Dorset Dialect.** New Edition, complete in one vol. Crown 8vo, 6*s.*

BLUNT, Wilfrid Scawen.—**The Wind and the Whirlwind.** Demy 8vo, 1*s.* 6*d.*

The Love Sonnets of Proteus. Fifth Edition. Elzevir 8vo, 5*s.*

In Vinculis. With Portrait. Elzevir 8vo, 5*s.*

A New Pilgrimage, and other Poems. Elzevir 8vo, 5*s.*

BRYANT, W. C.—**Poems.** Cheap Edition, with Frontispiece. Small crown 8vo, 3*s.* 6*d.*

CODD, John.—**A Legend of the Middle Ages,** and other Songs of the Past and Present. Crown 8vo, 4*s.*

DASH, Blancor.—**Tales of a Tennis Party.** Small crown 8vo, 5*s.*

DAWE, William.—**Sketches in Verse.** Small crown 8vo, 3*s.* 6*d.*

DAWSON, C. A.—**Sappho.** Small crown 8vo, 5*s.*

DE VERE, Aubrey.—**Poetical Works.**

I. The Search after Proserpine, etc. 3*s.* 6*d.*
II. The Legends of St. Patrick, etc. 3*s.* 6*d.*
III. Alexander the Great, etc. 3*s.* 6*d.*

The Foray of Queen Meave, and other Legends of Ireland's Heroic Age. Small crown 8vo, 3*s.* 6*d.*

Legends of the Saxon Saints. Small crown 8vo, 3*s.* 6*d.*

Legends and Records of the Church and the Empire. Small crown 8vo, 3*s.* 6*d.*

DOBSON, Austin.—**Old World Idylls,** and other Verses. Elzevir 8vo, gilt top, 6*s.*

At the Sign of the Lyre. Elzevir 8vo, gilt top, 6*s.*

DOYLE, J.—**Cause.** Small crown 8vo, 6*s.*

DURANT, Héloïse.—**Dante.** A Dramatic Poem. Small crown 8vo, 5*s.*

DUTT, Toru.—**A Sheaf Gleaned in French Fields.** Demy 8vo, 10*s.* 6*d.*

Ancient Ballads and Legends of Hindustan. With an Introductory Memoir by Edmund Gosse. 18mo. Cloth extra, gilt top, 5*s.*

Elegies and Memorials. By A. and L. Fcap. 8vo, 2*s.* 6*d.*

ELLIOTT, Ebenezer, The Corn Law Rhymer.—**Poems.** Edited by his son, the Rev. Edwin Elliott, of St. John's, Antigua. 2 vols. Crown 8vo, 18*s.*

English Verse. Edited by W. J. Linton and R. H. Stoddard. 5 vols. Crown 8vo, cloth, 5*s.* each.

I. Chaucer to Burns.
II. Translations.
III. Lyrics of the Nineteenth Century.
IV. Dramatic Scenes and Characters.
V. Ballads and Romances.

FIFE-COOKSON, Lieut.-Col.—**The Empire of Man.** Small crown 8vo, 2*s.* 6*d.*

GARRICK, H. B. W.—**India.** A Descriptive Poem. Crown 8vo, 7*s.* 6*d.*

GOSSE, Edmund.—**New Poems.** Crown 8vo, 7*s.* 6*d.*

Firdausi in Exile, and other Poems. Second Edition. Elzevir 8vo, gilt top, 6*s.*

On Viol and Flute; Lyrical Poems. With Frontispiece by L. Alma Tadema, R.A., and Tailpiece by Hamo Thornycroft, R.A. Elzevir 8vo, 6*s.*

GRAY, Maxwell.—**Westminster Chimes,** and other Poems. Small crown 8vo, 5*s*.

GURNEY, Rev. Alfred.—**The Vision of the Eucharist,** and other Poems. Crown 8vo, 5*s*.

A Christmas Faggot. Small crown 8vo, 5*s*.

Voices from the Holy Sepulchre. Crown 8vo, 5*s*.

HARRISON, Clifford.—**In Hours of Leisure.** Second Edition. Crown 8vo, 5*s*.

HEINE, Heinrich.—**The Love-Songs of.** Englished by H. B. BRIGGS. Post 8vo, parchment, 3*s*. 6*d*.

HUES, Ivan.—**Heart to Heart.** Small crown 8vo, 5*s*.

INGLEBY, Holcombe.—**Echoes from Naples, and Other Poems.** With Illustrations by his Wife. Crown 8vo, 3*s*. 6*d*.

KEATS, John.—**Poetical Works.** Edited by W. T. ARNOLD. Large crown 8vo, choicely printed on hand-made paper, with Portrait in *eau-forte*. Parchment or cloth, 12*s*.; vellum, 15*s*. New Edition. Crown 8vo, cloth, 3*s*. 6*d*.

KING, Mrs. Hamilton.—**The Disciples.** Tenth Edition. Small crown 8vo, 5*s*. Elzevir Edition. Cloth extra, 6*s*.

A Book of Dreams. Third Edition. Crown 8vo, 3*s*. 6*d*.

The Sermon in the Hospital (from "The Disciples"). Fcap. 8vo, 1*s*. Cheap Edition for distribution 3*d*., or 20*s*. per 100.

Ballads of the North, and other Poems. Crown 8vo, 5*s*.

LANG, A.—**XXXII. Ballades in Blue China.** Elzevir 8vo, 5*s*.

Rhymes à la Mode. With Frontispiece by E. A. ABBEY. Second Edition. Elzevir 8vo, cloth extra, gilt top, 5*s*.

Living English Poets MDCCCLXXXII. With Frontispiece by WALTER CRANE. Second Edition. Large crown 8vo. Printed on hand-made paper. Parchment or cloth, 12*s*.; vellum, 15*s*.

LOCKER, F.—**London Lyrics.** Tenth Edition. With Portrait, Elzevir 8vo, cloth extra, gilt top, 5*s*.

LULWORTH, Eric.—**Sunshine and Shower,** and other Poems. Small crown 8vo, 5*s*.

LYALL, Sir Alfred.—**Verses written in India.** Elzevir 8vo, gilt top, 5*s*.

MASSEY, Gerald.—**My Lyrical Life.** Poems Old and New. Two Series. Fcap. 8vo, 5*s*. each.

MEREDITH, Owen [The Earl of Lytton].—**Lucile.** New Edition. With 32 Illustrations. 16mo, 3*s*. 6*d*. Cloth extra, gilt edges, 4*s*. 6*d*.

MORRIS, Lewis.—**Poetical Works of.** New and Cheaper Editions. In 5 vols., 5*s.* each.

Vol. I. contains "Songs of Two Worlds." Thirteenth Edition.
Vol. II. contains "The Epic of Hades." Twenty-third Edition.
Vol. III. contains "Gwen" and "The Ode of Life." Seventh Edition.
Vol. IV. contains "Songs Unsung" and "Gycia." Fifth Edition.
Vol. V. contains "Songs of Britain." Third Edition. Fcap. 8vo, 5*s.*

Poetical Works. Complete in 1 vol. Crown 8vo, 6*s.*

The Epic of Hades. With 16 Autotype Illustrations, after the Drawings of the late George R. Chapman. 4to, cloth extra, gilt leaves, 21*s.*

The Epic of Hades. Presentation Edition. 4to, cloth extra, gilt leaves, 10*s.* 6*d.*

The Lewis Morris Birthday Book. Edited by S. S. COPEMAN, with Frontispiece after a Design by the late George R. Chapman. 32mo, cloth extra, gilt edges, 2*s.*; cloth limp, 1*s.* 6*d.*

OWEN, John.—**Verse Musings on Nature.** Faith and Freedom. Crown 8vo, 7*s.* 6*d.*

PFEIFFER, Emily.—**Flowers of the Night.** Crown 8vo, 6*s.*

PIERCE, J.—**In Cloud and Sunshine.** A Volume of Poems. Fcap. 8vo, 5*s.*

POE, Edgar Allan.—**The Raven.** With Commentary by JOHN H. INGRAM. Crown 8vo, parchment, 6*s.*

Rare Poems of the 16th and 17th Centuries. Edited by W. J. LINTON. Crown 8vo, 5*s.*

ROWBOTHAM, J. F.—**The Human Epic.** Canto i. Crown 8vo, 1*s.* 6*d.*

RUNEBERG, Johan Ludvig.—**Nadeschda.** A Romantic Poem in Nine Cantos. Translated from the Swedish by Miss MARIE A. BROWN (Mrs. JOHN B. SHIPLEY). With Illustrations. 8vo. [*In preparation.*

SCOTT, G. F. E.—**Sursum Corda**; or, Songs and Service. Small crown 8vo, 5*s.*

SEARELLE, Luscombe.—**The Dawn of Death.** Crown 8vo, 4*s.* 6*d.*

SYMONDS, John Addington.—**Vagabunduli Libellus.** Crown 8vo, 6*s.*

TAYLOR, Sir H.—**Works.** Complete in Five Volumes. Crown 8vo, 30*s.*

Philip Van Artevelde. Fcap. 8vo, 3*s.* 6*d.*

The Virgin Widow, etc. Fcap. 8vo, 3*s.* 6*d.*

TRENCH, Archbishop.—**Poems.** Collected and Arranged anew. Tenth Edition. Fcap. 8vo, 7*s.* 6*d.*

Poems. Library Edition. 2 vols. Small crown 8vo, 10*s.*

Sacred Latin Poetry. Chiefly Lyrical, Selected and Arranged for Use. Third Edition, Corrected and Improved. Fcap. 8vo, 7*s.*

Twilight and Candleshades. By EXUL. With 15 Vignettes. Small crown 8vo, 5*s.*

TYNAN, Katherine.—**Louise de la Valliere,** and other Poems. Small crown 8vo, 3*s.* 6*d.*

Shamrocks. Small crown 8vo, 5*s.*

WADDIE, John.—**Divine Philosophy.** Small crown 8vo, 5*s.*

WILSON, Crawford.—**Pastorals and Poems.** Crown 8vo, 7*s.* 6*d.*

Wordsworth Birthday Book (The). Edited by ADELAIDE and VIOLET WORDSWORTH. 32mo, limp cloth, 1*s.* 6*d.*; cloth extra, 2*s.*

Wordsworth, Selections from. By WM. KNIGHT and other members of the Wordsworth Society. Large crown 8vo. Printed on hand-made paper. With Portrait. Parchment, 12*s.*; vellum, 15*s.*

YEATS, W. B.—**The Wanderings of Oisin,** and other Poems. Small crown 8vo, 5*s.*

NOVELS AND TALES.

BANKS, Mrs. G. L.—**God's Providence House.** Crown 8vo, 6*s.*

BILLER, Emma.—**Ulli.** The Story of a Neglected Girl. Translated from the German by A. B. DAISY ROST. Crown 8vo, 6*s.*

CABLE, G. W.—**Strange True Stories of Louisiana.** 8vo, 7*s.* 6*d.*

CAIRD, Mona.—**The Wing of Azrael.** Crown 8vo, 6*s.*

COLERIDGE, Hon. Stephen.—**The Sanctity of Confession.** A Romance. Crown 8vo, 5*s.*

CRAWFURD, Oswald.—**Sylvia Arden.** With Frontispiece. Crown 8vo, 1*s.*

DERING, Ross George.—**Giraldi;** or, The Curse of Love. A Tale of the Sects. 2 vols. Crown 8vo, 12*s.*

EBERS, Georg.—**Margery.** A Tale of Old Nuremberg. Translated from the German by CLARA BELL. 2 vols. 8*s.*; paper, 5*s.*

ECKSTEIN, Ernst.—**Nero.** A Romance. Translated from the German by CLARA BELL and MARY J. SAFFORD. 2 vols. Paper, 5*s*.

FLETCHER, J. S.—**Andrewlina.** Crown 8vo, cloth, 1*s*. 6*d*.; paper covers, 1*s*.

The Winding Way. Crown 8vo.

FRANCIS, Frances.—**Mosquito.** A Tale of the Mexican Frontier. Crown 8vo, 3*s*. 6*d*.

GALDOS, B. Perez.—**Leon Roche.** A Romance. From the Spanish by CLARA BELL. 2 vols. 16mo, cloth, 8*s*.; paper, 5*s*.

GARDINER, Linda.—**His Heritage.** With Frontispiece. Crown 8vo, 6*s*.

GRAY, Maxwell.—**The Reproach of Annesley.** With Frontispiece. Crown 8vo, 6*s*.

Silence of Dean Maitland. With Frontispiece. Crown 8vo, 6*s*.

GREY, Rowland.—**In Sunny Switzerland.** A Tale of Six Weeks. Second Edition. Small crown 8vo, 5*s*.

Lindenblumen and other Stories. Small crown 8vo, 5*s*.

By Virtue of his Office. Crown 8vo, 6*s*.

Jacob's Letter, and other Stories. Crown 8vo, 6*s*.

HARRIS, Emily Marion.—**Lady Dobbs.** A Novel. In 2 vols. 21*s*.

HUNTER, Hay, and WHYTE, Walter.—**My Ducats and My Daughter.** With Frontispiece. Crown 8vo, 6*s*.

INGELOW, Jean.—**Off the Skelligs.** A Novel. With Frontispiece. Crown 8vo, 6*s*.

LANG, Andrew.—**In the Wrong Paradise,** and other Stories. Crown 8vo, 6*s*.

MACDONALD, G.—**Donal Grant.** A Novel. With Frontispiece. Crown 8vo, 6*s*.

Home Again. With Frontispiece. Crown 8vo, 6*s*.

Castle Warlock. A Novel. With Frontispiece. Crown 8vo, 6*s*.

Malcolm. With Portrait of the Author engraved on Steel. Crown 8vo, 6*s*.

The Marquis of Lossie. With Frontispiece. Crown 8vo, 6*s*.

St. George and St. Michael. With Frontispiece. Crown 8vo, 6*s*.

What's Mine's Mine. With Frontispiece. Crown 8vo, 6*s*.

Annals of a Quiet Neighbourhood. With Frontispiece. Crown 8vo, 6*s*.

The Seaboard Parish: a Sequel to "Annals of a Quiet Neighbourhood." With Frontispiece. Crown 8vo, 6*s*.

MACDONALD, G.—continued.

Wilfred Cumbermede. An Autobiographical Story. With Frontispiece. Crown 8vo, 6*s*.

Thomas Wingfold, Curate. With Frontispiece. Crown 8vo, 6*s*.

Paul Faber, Surgeon. With Frontispiece. Crown 8vo, 6*s*.

The Elect Lady. With Frontispiece. Crown 8vo, 6*s*.

MALET, Lucas.—**Colonel Enderby's Wife.** A Novel. With Frontispiece. Crown 8vo, 6*s*.

A Counsel of Perfection. With Frontispiece. Crown 8vo, 6*s*.

MULHOLLAND, Rosa.—**Marcella Grace.** An Irish Novel. Crown 8vo, 6*s*.

A Fair Emigrant. With Frontispiece. Crown 8vo, 6*s*.

OGLE, Anna C.—**A Lost Love.** Small crown 8vo, 2*s*. 6*d*.

PONTOPIDDAN, Henrik. — **The Apothecary's Daughters.** Translated from the Danish by GORDIUS NIELSEN. Crown 8vo, 3*s*. 6*d*.

ROBINSON, Sir J. C.—**The Dead Sailor,** and other Stories. Crown 8vo, 5*s*.

SAVILE, Ames.—**A Match Pair.** 2 vols. 21*s*.

SEVERNE, Florence.—**The Pillar House.** With Frontispiece. Crown 8vo, 6*s*.

SHAW, Flora L.—**Castle Blair:** a Story of Youthful Days. Crown 8vo, 3*s*. 6*d*.

STRETTON, Hesba.—**Through a Needle's Eye.** A Story. With Frontispiece. Crown 8vo, 6*s*.

TASMA.—**A Sydney Sovereign, and other Tales.** Crown 8vo, cloth, 6*s*.

Uncle Piper of Piper's Hill. An Australian Novel. Third Edition. Crown 8vo, 6*s*.

In her Earliest Youth. 3 vols. Crown 8vo, 31*s*. 6*d*.

TAYLOR, Col. Meadows, C.S.I., M.R.I.A.—**Seeta.** A Novel. With Frontispiece. Crown 8vo, 6*s*.

Tippoo Sultaun: a Tale of the Mysore War. With Frontispiece. Crown 8vo, 6*s*.

Ralph Darnell. With Frontispiece. Crown 8vo, 6*s*.

A Noble Queen. With Frontispiece. Crown 8vo, 6*s*.

The Confessions of a Thug. With Frontispiece. Crown 8vo, 6*s*.

Tara: a Mahratta Tale. With Frontispiece. Crown 8vo, 6*s*.

TOORGEYNIEFF, Ivan.—**The Unfortunate One.** A Novel. Translated from the Russian by A. R. THOMPSON. Crown 8vo, 3*s.* 6*d.*

TREHERNE, Mrs.—**A Summer in a Dutch Country House.** Crown 8vo, 6*s.*

Within Sound of the Sea. With Frontispiece. Crown 8vo, 6*s.*

BOOKS FOR THE YOUNG.

Brave Men's Footsteps. A Book of Example and Anecdote for Young People. By the Editor of "Men who have Risen." With 4 Illustrations by C. DOYLE. Ninth Edition. Crown 8vo, 2*s.* 6*d.*

COXHEAD, Ethel.—**Birds and Babies.** With 33 Illustrations. Second Edition. Imp. 16mo, cloth, 1*s.*

DAVIES, G. Christopher.—**Rambles and Adventures of our School Field Club.** With 4 Illustrations. New and Cheaper Edition. Crown 8vo, 3*s.* 6*d.*

EDMONDS, Herbert.—**Well-Spent Lives**: a Series of Modern Biographies. New and Cheaper Edition. Crown 8vo, 3*s.* 6*d.*

MAC KENNA, S. J.—**Plucky Fellows.** A Book for Boys. With 6 Illustrations. Fifth Edition. Crown 8vo, 3*s.* 6*d.*

MALET, Lucas.—**Little Peter.** A Christmas Morality for Children of any Age. With numerous Illustrations. Fourth Thousand. 5*s.*

REANEY, Mrs. G. S.—**Waking and Working**; or, From Girlhood to Womanhood. New and Cheaper Edition. With a Frontispiece. Crown 8vo, 3*s.* 6*d.*

Blessing and Blessed: a Sketch of Girl Life. New and Cheaper Edition. Crown 8vo, 3*s.* 6*d.*

Rose Gurney's Discovery. A Story for Girls. Dedicated to their Mothers. Crown 8vo, 3*s.* 6*d.*

English Girls: their Place and Power. With Preface by the Rev. R. W. Dale. Fifth Edition. Fcap. 8vo, 2*s.* 6*d.*

Just Anyone, and other Stories. Three Illustrations. Royal 16mo, 1*s.* 6*d.*

Sunbeam Willie, and other Stories. Three Illustrations. Royal 16mo, 1*s.* 6*d.*

Sunshine Jenny, and other Stories. Three Illustrations. Royal 16mo, 1*s.* 6*d.*

STORR, Francis, and TURNER, Hawes.—**Canterbury Chimes**; or, Chaucer Tales re-told to Children. With 6 Illustrations from the Ellesmere Manuscript. Third Edition. Fcap. 8vo, 3*s.* 6*d.*

STRETTON, Hesba.—**David Lloyd's Last Will.** With 4 Illustrations. New Edition. Royal 16mo, 2*s.* 6*d.*

WHITAKER, Florence.—**Christy's Inheritance.** A London Story. Illustrated. Royal 16mo, 1*s.* 6*d.*

PERIODICALS.

Amateur Mechanical Society's Journal.—Irregular.

Anthropological Institute of Great Britain and Ireland (Journal of).—Quarterly, 5*s.*

Architect (American) and Building News.—Contains General Architectural News, Articles on Interior Decoration, Sanitary Engineering, Construction, Building Materials, etc. 4 full-page Illustrations accompany each Number. Weekly. Annual Subscription, 38*s.* Post free.

Bibliotheca Sacra.—Quarterly, 3*s.* 6*d.* Annual Subscription, 14*s.* Post free.

British Archæological Association (Journal of).—Quarterly, 8*s.*

British Chess Magazine.—Monthly, 8*d.*

British Homœopathic Society (Annals of).—Half-yearly, 2*s.* 6*d.*

Browning Society's Papers.—Irregular.

Calcutta Review.—Quarterly, 6*s.* Annual Subscription, 24*s.* Post free.

Cambridge Philological Society (Proceedings of).—Irregular.

Englishwoman's Review. — Social and Industrial Questions. Monthly, 6*d.*

Geological Magazine, or Monthly Journal of Geology, 1*s.* 6*d.* Annual Subscription, 18*s.* Post free.

Index Medicus.—A Monthly Classified Record of the Current Medical Literature of the World. Annual Subscription, 50*s.* Post free.

Indian Antiquary.—A Journal of Oriental Research in Archæology, History, Literature, Languages, Philosophy, Religion, Folk-Lore, etc. Annual Subscription, £2. Post free.

Indian Evangelical Review.—Annual Subscription, 10*s.*

Indian Magazine. Monthly, 6*d.*

Library Journal.—Official Organ of the Library Associations of America and of the United Kingdom. Monthly, 2*s.* 6*d.* Annual Subscription, 20*s.*, or with Co-operative Index, 25*s.* Post free.

Mathematics (American Journal of).—Quarterly, 7*s.* 6*d.* Annual Subscription, 24*s.* Post free.

Meister (The).—Journal of the Wagner Society. 4to, 1*s.*

Nineteenth Century.—Monthly, 2*s.* 6*d.*

Orientalist (The).—Monthly. Annual Subscription, 12*s.*

Orthodox Catholic Review.—Irregular.

Philological Society (Transactions and Proceedings of).—Irregular.

Psychical Research (Society of), Proceedings of.

Publishers' Weekly: The American Book-Trade Journal.—Annual Subscription, 18*s.* Post free.

Punjab Notes and Queries.—Monthly. Annual Subscription, 10*s.*

Revue Internationale.—Issued on the 10th and 25th of each Month. Annual Subscription, including postage, 36*s.*

Scientific American.—Weekly. Annual Subscription, 18*s.* Post free.

Supplement to ditto.—Weekly. Annual Subscription, 25*s.* Post free.

Science and Arts (Americal Journal of).—Monthly, 2*s.* 6*d.* Annual Subscription, 30*s.*

Speculative Philosophy (Journal of).—Quarterly, 4*s.* Annual Subscription, 16*s.* Post free, 17*s.*

Sun Artists.—Quarterly, 5*s.*

Sunday Review.—Organ of the Sunday Society for Opening Museums and Art Galleries on Sunday. Quarterly, 1*s.* Annual Subscription, 4*s.* 6*d.* Post free.

Theosophist (The).—Magazine of Oriental Philosophy, Art, Literature, and Occultism. Monthly, 2*s.*

Trübner's Record.—A Journal devoted to the Literature of the East, with Notes and Lists of Current American, European, and Colonial Publications. Small 4to, 2*s.* per number. Annual Subscription, 10*s.* Post free.

MESSRS.

KEGAN PAUL, TRENCH, TRÜBNER & CO.'S
(LIMITED)

EDITIONS OF

SHAKSPERE'S WORKS.

THE PARCHMENT LIBRARY EDITION.

THE AVON EDITION.

The Text of these Editions is mainly that of Delius. Wherever a variant reading is adopted, some good and recognized Shaksperian Critic has been followed. In no case is a new rendering of the text proposed; nor has it been thought necessary to distract the reader's attention by notes or comments

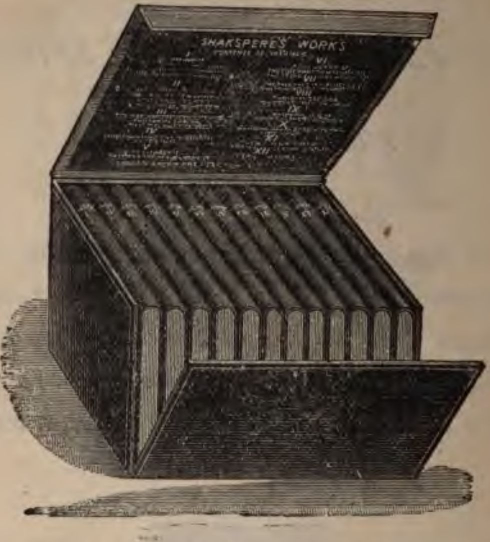
[P. T. O.

SHAKSPERE'S WORKS.

THE AVON EDITION.

Printed on thin opaque paper, and forming 12 handy volumes, cloth, 18*s*., or bound in 6 volumes, 15*s*.

The set of 12 volumes may also be had in a cloth box, price 21*s*., or bound in Roan, Persian, Crushed Persian Levant, Calf, or Morocco, and enclosed in an attractive leather box at prices from 31*s*. 6*d*. upwards.



SOME PRESS NOTICES.

"This edition will be useful to those who want a good text, well and clearly printed, in convenient little volumes that will slip easily into an overcoat pocket or a travelling-bag."—*St. James's Gazette.*

"We know no prettier edition of Shakspere for the price."—*Academy.*

"It is refreshing to meet with an edition of Shakspere of convenient size and low price, without either notes or introductions of any sort to distract the attention of the reader."—*Saturday Review.*

"It is exquisite. Each volume is handy, is beautifully printed, and in every way lends itself to the taste of the cultivated student of Shakspere."—*Scotsman.*

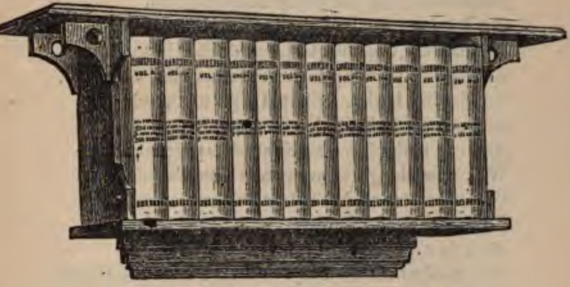
LONDON: KEGAN PAUL, TRENCH, TRÜBNER & CO., LTD.

SHAKSPERE'S WORKS.

THE PARCHMENT LIBRARY EDITION.

In 12 volumes Elzevir 8vo., choicely printed on hand-made paper, and bound in parchment or cloth, price £3 12*s.*, or in vellum, price £4 10*s.*

The set of 12 volumes may also be had in a strong cloth box, price £3 17*s.*, or with an oak hanging shelf, £3 18*s.*



SOME PRESS NOTICES.

". . . There is, perhaps, no edition in which the works of Shakspere can be read in such luxury of type and quiet distinction of form as this, and we warmly recommend it."—*Pall Mall Gazette.*

"For elegance of form and beauty of typography, no edition of Shakspere hitherto published has excelled the 'Parchment Library Edition.' . . . They are in the strictest sense pocket volumes, yet the type is bold, and, being on fine white hand-made paper, can hardly tax the weakest of sight. The print is judiciously confined to the text, notes being more appropriate to library editions. The whole will be comprised in the cream-coloured parchment which gives the name to the series." —*Daily News.*

"The Parchment Library Edition of Shakspere needs no further praise."—*Saturday Review.*

Just published. Price 5*s.*

AN INDEX TO THE WORKS OF SHAKSPERE.

Applicable to all editions of Shakspere, and giving reference, by topics, to notable passages and significant expressions; brief histories of the plays; geographical names and historic incidents; mention of all characters and sketches of important ones; together with explanations of allusions and obscure and obsolete words and phrases.

By **EVANGELINE M. O'CONNOR.**

LONDON: KEGAN PAUL, TRENCH, TRÜBNER & CO., LTD.

SHAKSPERE'S WORKS.

SPECIMEN OF TYPE.

4 *THE MERCHANT OF VENICE* ACT I

Salar. My wind, cooling my broth,
Would blow me to an ague, when I thought
What harm a wind too great might do at sea.
I should not see the sandy hour-glass run
But I should think of shallows and of flats,
And see my wealthy Andrew, dock'd in sand,
Vailing her high-top lower than her ribs
To kiss her burial. Should I go to church
And see the holy edifice of stone,
And not bethink me straight of dangerous rocks,
Which touching but my gentle vessel's side,
Would scatter all her spices on the stream,
Enrobe the roaring waters with my silks,
And, in a word, but even now worth this,
And now worth nothing? Shall I have the thought
To think on this, and shall I lack the thought
That such a thing bechanc'd would make me sad?
But tell not me: I know Antonio
Is sad to think upon his merchandise.
Ant. Believe me, no: I thank my fortune for it,
My ventures are not in one bottom trusted,
Nor to one place; nor is my whole estate
Upon the fortune of this present year:
Therefore my merchandise makes me not sad.
Salar. Why, then you are in love.
Ant. Fie, fie!
Salar. Not in love neither? Then let us say you are sad,
Because you are not merry; and 'twere as easy
For you to laugh, and leap, and say you are merry,
Because you are not sad. Now, by two-headed Janus,
Nature hath fram'd strange fellows in her time:
Some that will evermore peep through their eyes
And laugh like parrots at a bag-piper;
And other of such vinegar aspect

LONDON: KEGAN PAUL, TRENCH, TRÜBNER & CO., LTD.

PRINTED BY WILLIAM CLOWES AND SONS, LIMITED,
LONDON AND BECCLES.

JAN 15 1941